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A Year of Sudden Reverse in Iron and Steel

Features of the Trade of 1913—Reports from Leading Commercial Centers—The Sheet and Tin Plate Trades—Lake Superior Ore Trade

GENERAL REVIEW OF THE YEAR'S BUSINESS

A year of blight—this is the epitaph to be written on the tombstone of 1913. Opening with the most buoyant activity ever known in the iron trade, the whole industry being crowded to its utmost, the year ended with numerous idle plants, operations of steel works being at barely 50 per cent. of the productive capacity and the number of active blast furnaces the smallest since December, 1911. Probably never before has the trade seen such a complete change from insatiable demand to almost no interest among buyers, except in years of a financial panic. Lacking such a reason for the great decline in business, the change has been in the nature of a blight, which first attacked the pig-iron trade and then spread from one to another branch of the steel industry. The characteristics of the year were thus: 1. Excessive demand in the first three or four months. 2. Continuance of a high rate of production for at least six months after buying had been sharply checked. 3. Tremendous shrinkage in productive operations in November and December.

UNFAVORABLE GENERAL DEVELOPMENTS

Outside of the iron trade, the developments of the year were so preponderantly unfavorable that one can but marvel that the depression in the American iron business did not set in much sooner. The Balkan war, which had upset European financial calculations and caused purse strings to tighten on this side of the Atlantic, was a heritage from 1912 when 1913 began a new page in history. The people of the United States had voted in 1912 to reinstate in national power a political party that was known to be determined as speedily as possible after March 4, 1913, to reverse the fiscal policy to which the business interests of the country had been accustomed for a half century. In March unprecedented floods ravaged one of the richest sections of the Middle West, destroying many lives, wiping out of existence much valuable property and annihilating for a considerable period all means of communication, with a total loss in money value approximating as a catastrophe great historical fires and earthquakes. Late frosts in the spring months did far more damage than usual to fruits and vegetables in many States. In August and September the great corn belt was afflicted with continuous pitiless heat and a protracted drought that destroyed almost all vegetation in that important section of the country and caused a partial failure of the corn crop. And to add to all these unfavorable occurrences Congress was in session from early in the spring, slowly and tediously considering details of tariff revision, with disturbing rumors of drastic cuts in duties. From April to October the country was in a state of uncertainty over the tariff, business men generally hesitating to make commitments which might prove highly unprofitable upon the promulgation of the exact rates and the fixing of the date for the new tariff to go into effect.

HIGHLY PROSPEROUS CONDITIONS WHEN THE YEAR OPENED

The railroads contributed largely to the prosperity of the iron trade in the early months of 1913. They had placed heavy orders for cars, locomotives, rails and other supplies late in 1912, and the resultant demand for steel came on top of a large consumption by implement manufacturers, automobile builders, structural shops, ship yards, bridge builders and other fabricators of iron and steel into finished forms to meet the requirements of a busy and then prosperous nation.

So great was the demand for all classes of steel products that the largest steel makers were gorged with contracts which apparently mortgaged their entire output well into the third quarter of the year. Premiums were readily obtained by those manufacturers able to slip in an occasional order for early shipment. All finishing mills were operated at such a gait that the supply of semi-finished steel fell considerably short of the demand, and mill operations were from time to time checked on that account. Shipments of steel billets were made in large quan-

tities from works in eastern Pennsylvania to finishing mills in the vicinity of Pittsburgh. Even the largest mills of the United States Steel Corporation were unable to produce sufficient steel to satisfy their requirements and were obliged to buy billets and sheet bars from outside manufacturers. The pressure for semi-finished steel was so great that the construction of not less than 3,000,000 tons of new open-hearth steel capacity per annum was being hurried to completion, although but a year before the belief had been widespread that the country's steel-making capacity was more than 6,000,000 tons in excess of any probable requirement that could be foreseen. The demand for steel bars was extraordinarily heavy, running much in excess of the capacity of the mills, and iron rolling mills reaped a harvest. Consumers of bars, to a considerable extent, were obliged to turn to the use of iron bars to fill their urgent necessities. Iron rolling mills which had long been idle were rehabilitated and put in operation. A feature of this condition of business was the heavy demand on stocks carried in iron and steel warehouses, which had to be drawn upon, even at very high prices, by consumers who were in need of immediate supplies.

The enormous demand for steel products was responsible for the great activity of blast furnaces. The production of pig iron, which had been steadily growing since July, 1911, when 57,841 tons per day of coke pig iron was being made, culminated in February, 1913, in which month an average of 92,369 tons was turned out. At this time the total output of pig iron was at the rate of 34,350,000 tons a year, much above the highest production ever reached in any previous twelvemonth.

Prices of steel products, which in the latter part of the previous year had been considerably below the level of European prices, advanced in the early months of 1913 to a higher rate than in Europe. The largest steel companies endeavored to check the rising tide by continuing to quote reasonable prices for delivery several months ahead, but a time was finally reached when they could only take such contracts "to be delivered at the convenience of the mill," and buyers in urgent need of material were compelled to turn to the smaller establishments and pay much higher rates.

A noteworthy feature of the year was the almost continuous decline in the price of scrap. The supply at all times appeared to be much in excess of absorptive capacity of steel works, rolling mills and foundries.

The demand for coke expanded, of course, in proportion to the activity in the pig-iron trade, and prompt furnace coke sold at this time up to $4.25 per net ton at oven in the Connellsville region, while contract coke freely brought $3.25.

THE FIRST APPEARANCE OF WEAKENING

Weakness in pig iron began to manifest itself in January, as the steel companies having blast furnaces appeared to be able to satisfy their own demands and were not drawing on merchant furnaces. The foundry trade was not equal to the absorption of the production of these furnaces. This weakness extended further in February when the huge production of pig iron proved to have outrun the country's needs. In March the sellers of pig iron became anxious for business and much larger transactions were recorded than earlier in the year as the result of a lowering in prices.

The manufacturers of agricultural implements, who had found the steel-bar mills unable to supply their requirements in the latter part of 1912, began to inquire for bars in February, which was much in advance of their usual time for placing season contracts. From that time until late in the spring such contracts were placed at various intervals, but the bar manufacturers generally refused to take these contracts for an entire year, restricting them to six months.

In the second quarter of the year premiums on finished products shrank notably, notwithstanding the fact that the demand for billets and sheet bars continued to exceed the supply. About this time weakness began to develop in sheets, the very great increase in productive capacity beginning to make itself manifest. The floods in the Middle West, which stopped operations in a number of sheet mills, checked the decline, but their influence was only temporary and the downward movement continued steadily for the remainder of the year.

Much unfavorable comment was heard about the general condition of trade, but the finishing mills, especially the bar, plate and structural mills, were well booked and the rate of production kept up to full capacity.

Great scarcity of labor had made itself manifest, due to the heavy demand for workmen for all kinds of outdoor employment, and manufacturing establishments found themselves put to much trouble in endeavoring to keep their forces at maximum. Quite a number of strikes occurred, following demands for higher wages. In addition to strikes of common labor, some troubles broke out among the molders in several cities and the machinists at Buffalo. These strikes caused considerable inconvenience at the time, but were usually settled at slight concessions to the men.

THE THIRD QUARTER BRINGS A PIG-IRON MOVEMENT

At the beginning of the second half of the year the outlook for large crops in this country was exceedingly promising, the Western drought not having begun, and business sentiment improved, notwithstanding the fact that European trade conditions had become decidedly bad, while financial conditions had grown worse. Premiums for prompt shipment of finished products, however, disappeared, showing that new business was not being received by American mills in sufficient volume to promise the continuance of the high rate of production that had marked the previous months. At this time also tariff revision loomed up more largely as a disturbing factor.

Pig-iron prices had receded to such a point that buyers were tempted, Southern No. 2 foundry going as low as $10, Birmingham, and a good buying movement took place in July. Notwithstanding the better demand, the restriction of pig-iron production, which had been proceeding for some months, was not checked but furnaces continued to be blown out. The Connellsville coke producers endeavored to peg the price of furnace coke at $2.50 per net ton, at oven, in the hope of checking a decline, which was becoming quite pronounced with the lessening demand from iron makers. While no weakening occurred in contract prices of steel bars, plates and

shapes, prices of wire products and sheets declined quite sharply.

The buying of pig iron became so heavy in July and August as to lift prices from $1 to $1.50 per ton above the lowest point touched. About this time, however, in sharp contrast with the pig-iron situation generally, forced selling of Lake Superior charcoal pig iron at prices below the level of coke iron occurred in the West, which it subsequently developed was due to the reorganization of a large maker of that grade of iron.

In August and September steel billets and sheet bars became much more plentiful and prices receded, as new open-hearth steel capacity began to make itself felt. Plates and shapes sympathized with the movement in semi-finished steel, and prices of these products were shaded. The steel-bar trade, however, continued in excellent shape, the bar makers being able to get full prices.

A contest of endurance which had been on between the coke producers and the furnacemen was ended in September when some of the Connellsville producers began to sell coke on an independent basis at cut prices.

THE STEEL TRADE DECLINES RAPIDLY

In the latter part of the third quarter the steel market presented a different aspect from the pig-iron market. Steel prices steadily sagged while pig iron maintained its strength under the influence of the buying movement which had begun in July and continued rather actively until September, coupled with the restricted output.

In October, the month in which the new tariff act went into effect, complaints of slackening business were heard in every direction. While some rail buying in the West for 1914 was reported, business in all other finished lines fell off. Prices of sheets receded so much that makers were complaining that they had but a narrow margin of profit. Sharp competition developed in plates. Steel bars felt the effect of less trade, and concessions were made on contracts. Pig iron began to weaken again.

The decline in business was heavy in November. Prices of pig iron fell steadily, and numerous furnaces were blown out. Operations of steel works were greatly restricted, numerous plants running only on part time. While no sales of foreign iron and steel were reported, low quotations were being received in numerous quarters and these quotations undoubtedly had their influence on buyers, who held off in the expectation that domestic prices would eventually go still lower. At the beginning of December the rate of production of pig iron was down to 26,500,000 tons a year, and the production of steel ingots was estimated to be about 50 per cent. of the steel making capacity of the country.

The Pittsburgh Iron Trade in 1913

BY ROBERT A. WALKER

The year opened with prices high. Bessemer pig iron was selling at $17.25 and basic about $16.25, both at Valley furnace; steel billets for prompt shipment, $28 to $29; Bessemer sheet bars, Pittsburgh, $29 and higher; merchant steel bars for forward delivery, 1.40c., and for prompt delivery, 1.70c. and higher; plates, 1.50c. for forward delivery, and as high as 1.75c. for prompt delivery; beams, 1.50c. for forward shipment and 1.75c. and higher for prompt delivery; No. 28 black sheets, 2.35c.; No. 28 galvanized sheets, about 3.50c., and other articles of finished iron and steel proportionately high. The mills were filled with orders and not in position to make prompt shipments, so that consumers, when they could find a mill that could make deliveries wanted, were practically forced to pay whatever prices the mills quoted. These conditions continued until along in May and June, when a material slowing down in new business occurred. The mills were catching up on back deliveries, and gradually the large differential in prices for prompt and forward delivery were disappearing. By September, prices for either quick or forward delivery were practically side by side.

The output of all kinds of iron and steel in the first six months of 1913 was at a record breaking pace. Early in July the local situation was materially affected by the failure of the First-Second National Bank and the appointment of a receiver for the American Water Works & Guarantee Company. Runs of two or three days on several large banks in this city followed, and for a time it was feared there would be a repetition of the financial trouble of 1907, but happily this was averted. However, consumers were commencing to lose confidence and were declining to make contracts ahead, and in some cases were holding up specifications on contracts placed earlier.

The summer months were extremely dull, but there was general expectation of a good buying movement to start about September after the hot weather and the summer vacations were over, which was not fulfilled. There was a slight flurry in the pig-iron market in September. In the last half of 1913 new buying was almost at a standstill, the mills running largely on old contracts.

In the first seven or eight months of the year there was a decided shortage in the supply of steel, and premiums were paid by sheet and tin plate mills and other users to get prompt deliveries. Billets sold as high as $29, and sheet bars as high as $30 for prompt shipment. Of course, consumers having regular contracts with the steel mills were getting their steel at lower prices.

There was a gradual decline in the last three or four months of the year in prices on nearly all kinds of products, pig iron declining $2 to $3 a ton, steel billets and sheet bars $6 to $7, beams and channels $5, plates $5 to $6, steel bars $4 to $5 and sheets $6 to $8 a ton. These declines in prices did not bring about any increase in buying, but on the contrary had the effect of causing consumers to hold off still more, and in the last three or four months of 1913 buying was only for current needs and in small lots.

There was a marked contrast in the action of the mills in handling the situation in the last half of 1913, as compared with the depression in the early part of 1911. In that year the mills endeavored to run full and sold their products at extremely low prices and for long periods of delivery. In the depression of 1913 the mills adopted the re-

verse course, cutting down production and declining to take contracts for long delivery. In December the output of steel in the Pittsburgh district was not over 60 per cent. of productive capacity, while finishing mills were not running over 50 per cent., and in some lines were operating at a less rate.

The year closed with conditions in the steel trade extremely dull, but with a hopeful feeling that the early part of 1914 would show material betterment. It was believed that the passage of the currency bill would help to clarify the situation, and should the railroads be allowed the 5 per cent. advance in their rates, for which they have sought permission, it would also improve matters. In the second half of last year, purchases by the railroads were only nominal, the demand for steel cars and track material having been light.

There was a surplus of labor at the close of the year, in sharp contrast with the first part of 1913, when there was a decided scarcity, common labor commanding as high as $2.50 per day.

PIG IRON

The year opened with prices of pig iron ruling high and production at maximum rate. In January, Bessemer was selling at $17.25, Valley furnace; basic, $16.25 to $16.50; No. 2 foundry, about $17.50, and gray forge, $16.25. The weakness in other sections in February was stubbornly resisted in this district, but prices began to crumble in the spring and went down steadily until the close of the year. In July, Bessemer was selling at $15.75, a decline of $1.50 on January; basic, $14.25, a decline of $2; No. 2 foundry, $14, a decline of $3.50, and gray forge, $13.25, a decline of $3. In December, Bessemer was nominally $15, but had there been any demand it could have been bought at $14.50 or less. Sales of basic were made in December as low as $12.75; No. 2 foundry, $13.25, and gray forge, $13.

There were some notable additions to pig-iron capacity in the Pittsburgh district in 1913. The Pittsburgh Steel Company completed the building of two large blast furnaces at Monessen, Pa., with a combined daily capacity of about 1000 tons. The Youngstown Sheet & Tube Company added a fourth furnace at Youngstown, Ohio, with a daily capacity of 500 tons. The Republic Iron & Steel Company, Youngstown, increased its pig-iron output by the rebuilding of several furnaces. The furnace of the Clinton Iron & Steel Company in Pittsburgh, which collapsed early in the year, was rebuilt and put in operation in December on foundry iron, with a capacity of about 350 tons a day. At the close of 1913 there had been a sharp restriction in pig-iron output, the Carnegie Steel Company having but 28 furnaces out of 58 in blast, and other large steel concerns having only part of theirs running. The outlook is that pig-iron output will be still further restricted early in 1914.

The following table gives the average monthly prices for the year of Bessemer, basic, No. 2 foundry and gray forge iron, f.o.b. Valley furnace, to which 90c. per ton should be added for delivery in Pittsburgh:

Average Pig-Iron Prices, f.o.b. Valley Furnace in 1913

	Bessemer	Basic	No. 2 foundry	Gray forge
January	$17.25	$16.41	$17.50	$16.25
February	17.25	16.30	17.00	16.25
March	17.25	16.11	16.69	16.02
April	17.00	15.87	15.55	15.27
May	16.80	15.15	14.62	14.27
June	16.24	14.50	14.06	13.81
July	15.80	14.37	13.87	13.65
August	15.62	14.06	14.00	13.35
September	15.75	14.00	14.00	13.35
October	15.70	13.90	13.84	13.36
November	15.12	13.09	13.50	13.35
December	14.87	12.71	13.50	13.05

STEEL BILLETS

During the year 1913 extensive additions were made to open-hearth steel capacity in this territory, but there was no new Bessemer construction. Taking the plants of the Carnegie Steel Company at Bessemer, the Youngstown Sheet & Tube Company at Youngstown, the Pittsburgh Crucible Steel Company at Midland, the nearly completed plant of the Brier Hill Steel Company at Youngstown and a few additions to old plants of one to three furnaces, it is estimated that the increase in open-hearth yearly capacity in the Central West in 1913 was at least 2,500,000 tons.

The year opened with the steel market very active, all makers being much behind in shipments. Consumers were forced to pay premiums to get reasonably prompt deliveries. In January Bessemer billets were selling at about $27.50; open-hearth billets, $28.50; forging billets, $35; Bessemer sheet bars, $28, and open-hearth sheet bars $29, for prompt shipment. The market continued active up to May, at which time the mills began to catch up on deliveries, as the supply of steel had increased. In the latter part of June the consumers that were being supplied on contracts were advised that the price of billets for the third quarter would be $26.50 and for sheet bars $27.50, Pittsburgh or Youngstown mill. With the slowing down in operations among the finishing mills that started in the second half of the year the consumption of steel fell off materially and prices declined rapidly. In December the price of both Bessemer and open-hearth billets was $20, and Bessemer and open-hearth sheet bars $21 at maker's mill, showing a decline of $7 to $8 a ton from the high prices in the early part of the year.

STEEL RAILS

Operations at the three Edgar Thomson rail mills of the Carnegie Steel Company at Bessemer, Pa., were fairly active in 1913, especially in the first half of the year. Much of the foreign rail business secured by the United States Steel Products Company is rolled at the Edgar Thomson works, and this helped largely to keep the mills going. The addition of an open-hearth plant to the Edgar Thomson works, thus enabling the company to make open-hearth rails there, also helped to keep the plant more fully employed, as previously it had been the custom of the company to roll all open-hearth rails at its Ohio works at Youngstown. The price of standard section rails was maintained through the year at $28 per gross ton, and prices of light rails were also well maintained, the demand being good throughout the year, especially from the coal mining interests.

STRUCTURAL MATERIAL

The demand for structural steel was heavy for the greater part of 1913. The year opened with beams selling at 1.50c. for forward delivery and 1.75c. for prompt shipment. There was a great scarcity, all the mills being much behind in deliveries, and consumers paid premiums of $5 to $6 a ton for reasonably prompt shipment. This condition continued until April, when a slight slowing down was noticed, and the price for future delivery declined to 1.45c. In the early part of September the market was weak at 1.40c., and premiums for prompt delivery were disappearing, as the mills were catching up on deliveries. By October premiums had disappeared. The market declined steadily until December. Then sales were made at 1.25c., with some reported as low as 1.20c. The structural mills were pretty fully employed for the first nine months of the year, but in the last quar-

ter they were unable to operate at more than part capacity. The year closed with the steel fabricating interests having a fair amount of work on their books, but that placed in November and December was extremely light and competition was keen.

STEEL PLATES

The demand for steel plates in the first half of 1913 was enormously heavy, all the makers being loaded with business for three or four months ahead and much behind in deliveries. Premiums of $6 a ton or more were then paid for prompt shipment. The year opened with steel plates selling at 1.50c. for future delivery and 1.75c. and higher for prompt delivery. These prices were maintained until March, when a decline of about $1 a ton took place, the new demand having fallen off to some extent. In the last week in August another decline of $1 a ton took place, and premiums for prompt deliveries began to disappear, as the mills were catching up on deliveries. From this time until the end of the year prices declined $4 a ton or more. In December ¼-in. and heavier plates sold at 1.20c., and some business was placed at 1.15c. In the last quarter most of the mills were operating to about 50 per cent. of capacity.

IRON AND STEEL BARS

The demand for iron and steel bars in the first half of 1913 was extraordinary. The year opened with steel bars selling at 1.40c. for future delivery and as high as 1.70c. to 1.90c. for prompt delivery. Iron bars at this time were 1.70c. and hard to obtain for prompt delivery. In May and June the new demand slowed down and at the end of the year was very dull. Prices on both iron and steel bars materially declined in the last half, and at the close of December steel bars were 1.20c., with sales reported at $1 a ton less. Iron bars were quoted at about 1.35c., Pittsburgh mill. Iron and steel bar mills had little business ahead at the close of the year.

SHEETS

At the opening of 1913 specifications against contracts were much in excess of the output, with a continuously strong new demand, so that the mills were getting steadily further behind in deliveries. In the early part of January No. 28 Bessemer black sheets were firm at 2.25c., and No. 28 galvanized 3.40c., consumers paying premiums over these prices for prompt shipments. In the early part of March No. 28 Bessemer black sheets were 2.35c. and No. 28 galvanized 3.50c., with the mills from 8 to 12 weeks back in deliveries. In June the new demand began to slow down, and large consumers were not taking out sheets promptly on their contracts. In the early part of July prices weakened and in the last three months of the year materially declined. In the last week in December No. 28 Bessemer black sheets were selling as low as 1.85c. and No. 28 galvanized 2.85c. The mills, however, were refusing to book contracts for forward delivery at these prices, believing that early in 1914 the sheet market would improve both in demand and in prices.

TIN PLATES

This trade was only fairly satisfactory in 1913. In January the price of 100-lb. coke plates was $3.60 and 100 lb. ternes $3.45, but tin plate was being sold at about 10c. under. In the latter part of March a heavy flood visited western Pennsylvania and eastern Ohio, and a great many tin mills were put out of commission for upward of two weeks. This made a material reduction in output, which helped the market. In the summer specifications against contracts were dull, and all the tin plate mills began to run short of work. In July the Amalgamated Association declared a strike at the Pope works of the Phillips Sheet & Tin Plate Company at Steubenville, Ohio, which had refused to sign the scale. An effort was made by the company to run the mill on the open shop plan, but this was abandoned, and the plant was closed down and is still idle. In August there was a decline of about 10c. per box, 100 lb. cokes being freely offered at $3.50 and 100 lb. ternes at $3.45 per base box, and the demand was dull. On November 4 the American Sheet & Tin Plate Company announced its price on tin plate for 1914 on the basis of $3.40 for 100 lb. cokes and $3.30 for 100 lb. ternes. These prices were obtained for a large tonnage of tin plate for delivery during the year 1914, but to some of the largest consumers the usual differentials of 5 to 10c. or more under these prices were allowed. At the close of the year the tin plate mills were operating to only about 50 per cent. of capacity.

MERCHANT PIPE

From the standpoint of sustained demand the year 1913 in the iron and steel pipe trade was probably better than in any other line of finished product. In the first half of 1913 all the mills operated to their utmost capacity and were much behind in deliveries. In the second half there was a slight slowing down, but not as much as in other lines. The year 1913 was one of the best ever known in the pipe trade, and the outlook for the new year is regarded as fairly good.

IRON AND STEEL SCRAP

In January and February prices were fairly good, heavy steel scrap selling at the beginning of the year at $15, and other grades proportionately high. In May and June, however, the demand began to slow down, and for the last six months conditions were bad, with prices on some classes of scrap lower than ever known in the history of this trade. At the close of the year selected heavy steel scrap was selling at $11. The following table shows the average monthly prices of a number of classes of scrap, averaged from weekly quotations in *The Iron Age:*

Average Old Material Prices, Gross Ton, Pittsburgh, in 1913

	Heavy steel scrap	No. 1 foundry cast	Bundled sheet scrap	Re-rolling rails	Cast iron borings	Machine shop turnings
January	$14.95	$14.50	$12.75	$16.35	$10.13	$10.50
February ...	14.12	14.50	11.39	16.25	10.06	9.37
March	14.18	14.25	10.62	16.25	10.00	8.50
April	14.15	14.25	10.35	16.05	10.15	8.00
May	13.55	13.62	9.50	14.87	9.25	7.69
June	12.62	12.87	8.69	14.50	8.37	6.62
July	12.40	12.75	8.50	14.50	8.25	6.55
August	12.37	12.75	8.25	14.50	8.25	6.75
September ...	12.25	12.75	8.00	14.25	8.19	6.94
October	11.85	12.35	7.15	13.45	8.10	6.95
November ...	11.44	12.00	6.56	13.42	7.25	6.50
December ...	11.08	12.00	6.50	13.45	7.25	6.50

COKE

The coke trade in the first half of 1913 was very satisfactory, prices ruling high and the demand being heavy, owing to the unprecedented activity of blast furnaces. In January standard makes of furnace coke for spot shipment were selling at $4 at oven and higher; on contracts, at about $3.25 per net ton at oven. These prices, however, were not maintained long, as in April best grades were selling as low as $2.25 and there was little doing in contracts. In the third quarter the operators endeavored to maintain a price of $2.50, but were un-

successful. Some sales were made at this figure, prices being guaranteed against decline, but in the last three months of the year prices steadily declined. At the close of December best grades of furnace coke for spot shipment were selling at $1.75, and contracts for standard grade furnace coke for first half of 1914 were made as low as $1.80 and up to $1.90 per net ton at oven. The following table shows the average monthly prices per net ton at oven on prompt and contract furnace and foundry coke during 1913, averaged from weekly quotations in *The Iron Age:*

Average Monthly Prices, Per Net Ton at Oven, of Connellsville Coke in 1913

	Prompt furnace coke	Contract furnace coke	Prompt foundry coke	Contract foundry coke
January	$3.88	$3.19	$4.40	$3.62
February	2.52	2.62	3.25	3.25
March	2.40	2.50	3.00	3.00
April	2.15	2.25	3.00	3.00
May	2.13	2.25	2.89	2.96
June	2.11	2.25	2.80	3.00
July	2.45	2.44	2.70	3.00
August	2.50	2.50	2.90	3.00
September	2.29	2.37	2.90	3.00
October	2.08	2.19	2.81	2.95
November	1.82	1.97	2.60	2.75
December	1.75	1.83	2.50	2.63

The Philadelphia Iron Trade in 1913

BY A. A. MILLER

The year opened with business in the Philadelphia territory at close to the highest mark. Producers had orders sufficient to keep them busy months ahead and prompt deliveries were hard to obtain. Activity continued during the early months of the year, but as summer approached hesitancy became pronounced and business steadily declined. Toward the end of the year heavy curtailments in pig-iron production became effective, and finishing mills were operating at about one-half of their productive capacity.

Prices during 1913 were more uniformly based on supply and demand than usual. Many mills, having entered contracts for extended delivery, were unable to meet the current demand during the first half, while others, which followed the policy of selling only for near future delivery, obtained sharp premiums for prompt shipments on nearly all classes of material. This condition prevailed until early summer, when the mills generally, having caught up with old contracts, entered new business at several dollars a ton below premium figures. Midsummer marked the beginning of the downward movement of finished material prices and the decline was steady until the year end. In pig iron prices steadily declined almost throughout the entire year.

One of the most pronounced exceptions to the decline in industrial activity was ship building. Practically every shipyard in this vicinity entered record business and operated at top capacity throughout the year. Vessels to enter the Panama Canal trade figured largely in the year's business.

Tariff reductions, together with the entire removal of the duty on pig iron, iron ore, ferromanganese and crude steel, which became effective in October, did not induce importations of foreign materials. Business had declined sharply by that time, and prices abroad were mostly at a level which prohibited importations, even duty free. In instances where prices were lower than domestic quotations, and they were but few, quotations on foreign materials were unusually met by domestic makers.

IRON ORE

Heavy purchases of ore for this year's delivery were made late in 1912 and few large contracts were closed in 1913. A steadily declining pig-iron market restricted buying. The most important transaction involved 500,000 tons of Venezuelan ore, covering five years' delivery. In September the initial cargo of Texas iron ore from Port Bolivar, Texas, was received at this port. Importations during 1913 aggregated approximately 1,325,000 tons, divided as follows: Cuba, 476,950 tons; Sweden, 375,000 tons; Newfoundland, 205,000 tons; Spain, 109,307 tons; New Brunswick, 72,260 tons; Venezuela, 58,646 tons; scattered, 20,000 tons. Considerable ore contracted for this year's shipment will be carried over, as furnaces, owing to decreased activity, have been unable to stock all the ore for which they contracted. Importations of Swedish ore, largely on contracts, will total about 400,000 tons in 1914. As a rule, prices of ore during the second half were slightly lower than those at which contracts were made early in the year. In the fall consumers benefited further by the removal of the duty.

PIG IRON

The market favored the consumer almost throughout the year. Early requirements were largely covered by forward purchases late in 1912 and buyers making later intermittent purchases forced prices downward almost continuously. Producers, being pretty well covered during the early months, did not force business, but were compelled to make gradual concessions from time to time to induce buying.

Statistics compiled by the Eastern Pig Iron Association show that, with the exception of a few temporary spurts, the tonnage of unfilled orders on hand steadily decreased and at the close of the year were lower than for any period during the past six or more years. Stocks on hand increased from the beginning of the year until August, since which time they have steadily decreased, producers curtailing the output to the approximate consumption, rather than accumulate heavy stocks in time of light demand. At no time during the year have stocks on hand been equal to two weeks' capacity of the furnaces in the district.

Records compiled by the Virginia Pig Iron Association show unfilled orders and stocks on furnace yards at their highest in January. There was a steady decline, both in orders and stocks, until about midsummer when orders became practically stationary and stocks slightly increased. Early in the fall orders increased, only to decline again during the closing months. Stocks on hand showed a steady decrease from August, but increased in December. At the close of 1913 orders on Virginia furnace books represented but 30 per cent. of the volume at the beginning of the year, while stocks on hand represented 65 per cent. of the total on hand on January 1. In December stocks and unfilled orders were on a comparatively even basis.

Eastern Pennsylvania No. 2 X foundry declined from $18.80 delivered here, at the beginning of the year, to $15.50 in July, when a temporary buying

movement advanced the price 50c., but the gain was almost immediately lost. Virginia foundry moved irregularly, at times showing considerable variance from prices of Pennsylvania iron. The decline was steady from $16 at the opening down to $12.75 at furnace, at the close of the year. Cast-iron pipe makers in this district were intermittent buyers; at times round lots were taken, but considerable odd lot business was transacted. The movement in rolling mill forge iron was spasmodic. Purchases in the steel-making grades were irregular. With the exception of a few movements, when round lots of both basic and low phosphorus were taken, buying was scattered. During a considerable portion of the year basic was inactive and nominally quoted.

Following the removal of the duty on pig iron, considerable negotiation for Middlesbrough No. 3 ensued, but prices were higher than for equal domestic grades. A small lot of low phosphorus was the only sale in foreign steel-making grades.

The accompanying table shows the average range of minimum quotations by months for the principal grades of pig iron delivered in buyers' yards, eastern Pennsylvania and nearby points.

Average Prices of Pig Iron, Delivered in Buyers' Yards, Eastern Pennsylvania and Nearby Points, in 1913

	Penna. No. 2 X	Virginia No. 2 X	Standard gray forge	Basic	Standard low phos.
January	18.50	18.80	17.65	18.10	24.50
February	18.25	18.55	17.31	18.00	24.50
March	17.78	18.30	16.88	17.69	24.50
April	17.50	17.92	16.55	16.75	23.62
May	16.80	17.10	15.85	16.50	23.50
June	16.19	16.61	15.37	15.94	23.50
July	15.60	16.10	14.95	15.20	23.40
August	15.60	15.80	14.62	15.19	23.00
September	15.86	15.80	14.81	15.12	23.00
October	15.95	15.80	15.00	15.30	23.00
November	15.55	15.80	14.75	15.00	22.31
December	15.31	16.65	14.56	15.00	21.65

STEEL BILLETS

Early in the year buying was heavy, mills were loaded with orders for three to six months ahead, and prices of basic open-hearth rolling billets were firmly held at $32 delivered here, Western consumers bought heavily from Eastern makers and considerable steel was sold for shipment to Canada. Large inquiries came from abroad but mills were too fully engaged to consider the business seriously. Prompt lots frequently commanded a premium, ranging up to $4 a ton. During the second quarter, when tariff readjustments were under consideration, buying eased and prices gradually sagged. In October, following the removal of the duty, foreign rolling billets were offered at $23.35, seaboard, but the prices was met by domestic makers. In December rolling billets were quoted at $22.40 here. Forging billets followed the market on rolling billets at a spread of $4 to $5 a ton. During the first half of the year steel billet mill operations were at full capacity; early in the second half activities gradually fell off, and during the closing months producers found it difficult to maintain a 30 per cent. basis without accumulating stocks.

PLATES AND STRUCTURAL MATERIAL

Gradual decline from extreme activity to comparative dulness marked the movement in plates and shapes. Mill activities were at the fullest capacity early in the year and production records were frequently broken. Eastern mills followed a policy of conservative selling, dictated prices, and premiums for early shipment were general. The activity continued until late in April, when the demand became easier and mills gradually caught up on unfilled orders. Early in the summer lighter demand brought price concessions, with declines steady during the remainder of the year. In the last quarter business fell off sharply and production dropped to approximately 50 per cent.

Prices of plates in January showed a wide range. Western mills quoted 1.65c. here, with deliveries uncertain. Eastern mills booked orders freely for reasonable delivery at 1.75c. to 1.80c., universal plates commanding $1 advance over sheared plates. Quotations were firm until April, when 1.70c. to 1.75c. was quoted by Eastern makers. In May the differential between sheared and universal plates disappeared. In June Western plates were quoted at 1.60c. and Eastern plates at 1.65c., Eastern mills reluctantly meeting the lower prices. In September 1.60c. was shaded. In October 1.45c. was done on sharply competitive business and later in the year 1.35c. delivered was reached.

While makers of plain shapes were, to a large extent, booked farther ahead in the year than plate mills, the decline was felt earlier. Premiums for prompt shipment ruled up to April, quotations ranging from 1.65c. for forward to 1.75c. to 1.80c. for prompt shipment, while spot shipment frequently commanded 2c. In May 1.60c. to 1.65c. ruled for forward shapes and 1.70c. to 1.75c. for prompt. In midyear prices sagged to 1.60c., in September to 1.55c., and in October 1.50c. was reached. Sharp competition for business during the fall months brought gradual declines and at the close of the year prompt shipment was available at 1.35c. to 1.40c. delivered here, with very little forward business being booked.

SHEETS AND BARS

Sheet-mill operations were comparatively good almost through the entire year. At the opening of 1913 full capacity ruled and mills were further booked ahead on contracts than for years. This condition continued during the first quarter, Eastern mills readily obtaining premiums ranging from $1 to $3 a ton. In the second quarter forward buying was less in evidence, prices became easier, premiums gradually disappeared and in the second half buying became more and more quiet. No. 10 blue annealed sheets on January commanded 1.90c. here, with prompt shipments running up to 2.05c. These prices held until toward midyear when 1.90c. was quoted for both Western and Eastern sheets. In December prices were weak at 1.60c. to 1.65c. here.

Bar mill operations were more or less irregular. Increased productive capacity resulted in less general pressure. Premiums for prompt deliveries were effective during the early months, but the supply rapidly adjusted itself to the demand. In the spring a lighter demand brought weakness, with no recovery during the remainder of the year. A wide range of prices ruled at times, manufacturers of the better grades of iron bars refusing to make concessions as freely as common bar makers. Late in the year business was dull and activities were greatly restricted.

Ordinary iron bars opened the year at 1.67½c. for forward and 1.77½c. for prompt shipment. In March prices still held at 1.67½c., but covered prompt as well as forward shipment, with some mills holding at 1.72½c. In May 1.47½c. ruled; in July, 1.37½c.; by November 1.27½c. was reached, and in December the market was weak at 1.22½c. Prices of steel bars in January ranged from 1.55c. to 1.60c. here, for forward and 1.85c. for prompt shipment. Prompt bars gradually declined and by midyear both prompt and forward bars were available at 1.55c. Prices held at this basis pretty firmly until October, when they became weak and during the last quarter declined rapidly to 1.35c. here.

OLD MATERIAL

Consumers controlled the situation in 1913 to a large extent. Buying was in spurts, purchasers usually holding out for lower prices on each successive movement. At times quotations were purely nominal, owing to lack of interest. Frequently, prices considered low enough to be prohibitive were offered by consumers, which, however, ultimately resulted in business. No. 1 heavy melting steel was quoted at $14.50 delivered early in the year, declining slightly in February and making a partial recovery in March and April, but not reaching the higher prices of early in the year. From April to September there was a downward movement from $13.50 to $11.50, followed by a 25c. advance, but during the remainder of the year prices steadily declined, reaching in December, $10, the lowest price for this class of material in many years. Low phosphorus steel scrap declined steadily, the full drop being $5 a ton. No. 1 railroad wrought fell off approximately $3.50 a ton during the year. Toward the close of the year practically all kinds of old material were a drug on the market. The decline in general business made consumers wary and frequently they could not be induced to buy at any price. During the closing weeks of the year some inquiry, particularly for rolling mill grades for early 1914 delivery, had a tendency to strengthen the market, and the trade felt that the bottom, which had been looked for week after week, had at last arrived.

The range of quotations, showing the monthly average minimum price for the leading grades, delivered in buyers' yards in this territory, taking a freight rate varying from 35c. to $1.35 per gross ton from Philadelphia is given in the accompanying table, the average prices for 1911-1912 and 1913 being given in the closing columns.

Average Prices of Old Material, Delivered in Buyers' Yards, Eastern Pennsylvania, in 1913, Per Gross Ton

	Jan.	Feb.	Mar.	Apl.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Aver-age, 1913	Aver-age, 1912	Aver-age, 1911
No. 1 heavy steel...	$14.40	$12.87	$13.25	$13.44	$12.10	$11.75	$11.35	$11.43	$11.62	$11.15	$10.19	$10.00	$11.97	$13.59	$12.82
Low phos. steel.....	18.55	17.94	17.75	17.50	17.00	16.75	14.90	15.37	15.62	16.00	14.37	14.00	16.31	16.85	16.92
Iron rails	18.00	18.00	18.00	18.12	18.00	17.62	17.50	17.50	17.50	17.50	17.00	16.00	17.56	16.58	16.98
No. 1 railr'd wrought	16.10	15.12	15.25	15.37	15.00	14.75	13.90	14.00	14.68	14.00	13.00	12.75	14.49	15.57	15.54
Car wheels	16.20	15.37	15.00	14.87	13.75	13.12	12.30	12.37	12.75	12.46	12.00	12.00	13.51	13.73	12.80
Wrought-iron pipe...	13.25	12.50	12.62	12.82	12.20	11.62	11.20	11.00	11.06	10.90	9.12	8.50	11.39	12.75	12.41
Wrought turnings ...	11.20	10.37	10.12	10.31	9.20	8.00	7.85	8.00	8.00	7.85	7.00	7.08	8.74	10.27	8.68
Cast borings	10.85	10.37	10.06	10.25	9.17	8.25	7.85	7.94	8.18	7.90	7.50	7.17	8.79	9.64	8.18
Machinery cast	14.50	14.37	14.00	13.94	13.60	13.25	13.00	12.87	12.81	13.50	12.62	12.17	13.38	13.84	13.25
Stove plate	11.00	10.50	10.50	10.44	10.00	9.87	9.00	9.00	9.50	9.70	9.37	9.50	9.86	12.28	11.65
Railroad malleable..	13.50	13.50	13.00	13.00	17.60	12.00	11.50	11.00	11.00	11.00	10.50	9.66	11.85	10.36	10.05

The Chicago Iron Trade in 1913

BY O. J. ABELL

In the two years between January 1, 1912, and January 1, 1914, the iron and steel trade has run the full gamut of experience, ascending and descending, from empty order books to oversold capacity and back again to empty order books, from minimum profits to maximum, the proverbial cycle of feast and famine. The year 1913 may be described as a period of deceleration in which the momentum acquired under the impelling forces of 1912 was gradually dissipated.

In the first two months of the year the urgency and pressure of buying showed few signs of abating but as early as March the changing outlook began to be apparent. Under date of March 26 the following comment appeared in the current issue of *The Iron Age:* "Without the background of mill order books filled for several months to come, current developments in iron and steel would appear only moderately encouraging. The effects of the gradually reduced buying pressure are becoming more apparent, as with most of the mills the pendulum has begun to swing back toward easier delivery conditions." Four weeks later this statement appeared: "To those disposed to view the market so as to find in the immediate happenings a forecast of untoward events to come, the past week offers more excuse than has appeared in many months. * * * There are those who see in the tightness of money and in the more conservative attitude of purchasing departments, a growing feeling of uncertainty and caution."

UNPRECEDENTED ANTICIPATION OF REQUIREMENTS.

But it was not until the first half of the year had passed that the real trend of the market became obvious. This was due to the unprecedented anticipation of requirements by the railroads, in particular, and other users of steel. At one time early in the year one of the steel companies of the Chicago district having on its books contracts covering an aggregate of 1,700,000 tons to be shipped during the year had already received shipping orders applying against those contracts in excess of 1,000,000 tons. It is, therefore, apparent by what strength the market was sustained through the first three-quarters of the year despite the lack of new business which early appeared and the increasing tendency to limit purchases to those requirements which were pressing and for immediate needs.

Structural shapes and plates at 1.63c., Chicago, and steel bars at 1.58c., were subjected to practically no concessions until October, and even then the decline to the closing prices of the year, 1.38c. and 1.33c., was most gradual. During the placing of contracts, including the long-dragged-out negotiations of the agricultural implement interests, steel bars were sold in tonnages that engaged the capacity of the mills farther into the future than was true of either shapes or plates. As a result the market remained much firmer on steel bars by comparison, and the usual spread of $1 between bars and plates disappeared, at one period of the liquidation sheared plates being sold at even lower prices than bars. However satisfactory the year may have been to the makers of steel bars, it was even more profitable to the bar-iron mills at Chicago. Except during the period of premium prices which held for steel and iron alike until midsummer, the price of bar iron itself did not achieve an unusual record.

The value of scrap remained so consistently throughout the year without apparent benefit from the prosperous condition of the finished material

market that at no time did the price of rolling-mill scrap exceed 40 per cent. of the price of bar iron, while the ratio at times dropped as low as 35 per cent. The plentitude of scrap also resulted in numerous economies in connection with handling and with carrying charges, which further enhanced the profits of bar-iron operations.

THE SCRAP SITUATION OF GENERAL INTEREST.

The scrap or old material situation has been one of general interest throughout the year. Reference to the accompanying table of prices will show how values have fallen below those of previous years. More scrap has been offered for sale than the market could readily absorb. The disproportionate increase of scrap made from steel, in process of manufacture into finished products or worn-out in service, as compared with the purchase of steel scrap by the mills marketing steel in semi-finished forms, and the greatly reduced number of rolling mills, are two important reasons for this condition. Many other explanations have been cited. At Chicago the large accumulation of scrap by one of the railroads hung over the local market with a distinctly depressing influence.

To many who have followed this market the past year has seemed to inaugurate a readjustment of scrap values upon a lower level. It at least appears to be true that scrap prices may be expected to rise as business begins to improve with the steel mills; that they will reach their high point considerably in advance of the prices of finished materials, and that they will begin to recede as prosperity spreads among the users and fabricators of finished materials, who by their expanding operations create an increasing supply of scrap.

COMPARISON OF PRICES

The following tables show the course of prices in the Chicago market, compiled from the weekly reports in *The Iron Age:*

Average Chicago Prices of Pig Iron, 1913

	Northern coke No. 2	Lake Superior charcoal	Southern coke No. 2
January	$17.90	$18.15	$18.15
February	17.31	18.00	17.85
March	17.25	18.00	17.64
April	17.06	18.00	16.85
May	16.15	18.00	16.25
June	15.63	16.81	15.35
July	14.70	15.65	14.45
August	15.00	14.69	15.10
September	15.00	15.25	15.60
October	15.00	15.25	15.63
November	14.88	15.25	15.48
December	14.50	15.25	15.10
Average for year	$15.95	$16.50	$16.12
Average for 1912	$15.32	$16.77	$16.11
Average for 1911	14.87	16.96	14.80
Average for 1910	17.10	18.67	16.30
Average for 1909	17.49	19.50	17.30
Average for 1908	17.57	20.24	16.76
Average for 1907	24.50	26.56	24.47
Average for 1906	20.43	20.72	19.44
Average for 1905	17.65	17.99	16.66
Average for 1904	14.37	15.50	13.92
Average for 1903	19.25	22.13	18.31
Average for 1902	20.86	23.50	20.10
Average for 1901	15.38	17.50	14.60
Average for 1900	19.47	22.00	18.35

Average Chicago Base Prices of Finished Iron and Steel, 1913

	Common bar iron. Cents	Soft steel bars. Cents	Structural steel. Cents
January	1.57½	1.58	1.63
February	1.59	1.58	1.63
March	1.57½	1.58	1.63
April	1.57½	1.58	1.63
May	1.57½	1.58	1.63
June	1.50	1.58	1.63
July	1.50	1.58	1.63
August	1.43	1.58	1.63
September	1.35	1.58	1.63
October	1.26	1.57	1.59
November	1.15	1.45	1.58
December	1.13	1.35	1.41
Average for year	1.43	1.55	1.60
Average for 1912	1.32	1.42	1.46
Average for 1911	1.22	1.47	1.50
Average for 1910	1.45	1.62	1.66
Average for 1909	1.42	1.50	1.59
Average for 1908	1.56	1.66	1.82
Average for 1907	1.78	1.77	1.87
Average for 1906	1.71	1.68	1.86
Average for 1905	1.65	1.65	1.78
Average for 1904	1.41	1.50	1.71
Average for 1903	1.65	1.72	1.75
Average for 1902	1.71	1.73	1.75
Average for 1901	1.58	1.58	1.70
Average for 1900	1.75	1.75	2.00

Average Chicago Prices of Old Material, 1913

	Cast borings. Net ton	No. 1 railroad wrought. Net ton	Heavy cast scrap. Net ton	Heavy melting steel scrap. Gross ton	Old steel rails, rerolling. Gross ton
January	$6.95	$12.70	$12.90	$12.60	$16.15
February	6.50	12.19	12.69	12.13	15.50
March	6.63	12.13	12.50	12.08	15.00
April	6.69	12.38	12.44	12.50	14.63
May	5.55	11.25	11.60	11.25	13.95
June	4.81	10.56	10.63	10.44	12.69
July	4.80	10.55	10.70	10.50	12.35
August	5.00	10.63	10.88	10.56	12.13
September	4.69	10.19	10.63	10.06	12.25
October	4.50	9.60	10.40	10.00	12.15
November	4.31	9.00	10.06	9.56	12.00
December	3.91	8.50	9.83	9.00	11.33
Average for year	$4.78	$10.80	$10.44	$10.90	$13.33
Average for 1912	$6.67	$12.54	$12.29	$12.12	$14.19
Average for 1911	5.34	11.23	11.03	10.92	12.91
Average for 1910	5.50	12.99	13.32	13.43	16.34
Average for 1909	6.37	13.76	13.79	14.45	15.82
Average for 1908	5.37	12.45	12.69	12.45	14.40
Average for 1907	8.78	14.63	17.26	15.08	17.53
Average for 1906	8.69	15.62	14.55	14.74	17.15
Average for 1905	8.57	16.14	13.50	13.97	15.02
Average for 1904	4.72	12.45	10.95	10.72	12.54
Average for 1903	7.33	16.07	14.75	15.50	19.04
Average for 1902	8.89	19.68	15.03	17.37	23.35
Average for 1901	4.20	15.00	11.25	12.84	16.05
Average for 1900	6.65	15.00	11.00	12.84	15.50

FEATURES OF THE PIG-IRON TRADE.

To the producers of pig-iron, the market was hardly satisfactory at any time. The highest prices for local foundry iron during 1913 but reached the average level for the past decade, nor need one look farther than the record of idle furnace capacity to appreciate this situation. In the early part of 1912 one stack at Mayville, one at Bay View, the Thomas furnace at Milwaukee, one Federal furnace and the two new Iroquois furnaces were out of blast. With the increase in business in the latter part of 1912 and the advance in price to $18, most of this idle capacity came in but almost immediately after the first of the year the market again began to sag and production to be reduced. During the last half of the past year the capacity out of blast has been about as it was 12 months before.

It has been pointed out that the blast furnaces at Chicago and Milwaukee are hemmed in within narrow limits. Following 1898 and until 1911 there was but one year, 1904, when the average price of Northern foundry iron fell below $15, and but one other year, 1901, when the average price was below $17, while in 1907 the average price soared to more than $24. But in 1911, 1912 and 1913 the average prices for these years were $14.87, $15,32 and $14.40. If we are correct in accepting the statement that higher labor and ore costs more than offset the economies from improved operation, the profits of the furnaces have suffered even more than is indicated by the falling off in prices. With the increase of consumption in the district, additional furnace capacity might be expected to retrieve some of that loss through a larger volume of business.

In a rising tide of business local competition fixes the price up to a certain point which the record of the past five years apparently marks as the critical point at which outside competition enters. That critical point is approximately marked by the price of $18.50 at local furnace. In terms of price,

$18.50 is thus the measure of the isolation of the Chicago market and marks the volume of business beyond which local furnaces are no longer able to accumulate a back-log of orders with its accompaniment of premium prices. From the same circumstance, it is apparent that, except as consumption of pig-iron increases more rapidly than productive capacity, this price will be lower and the period in which it obtains shorter.

Southern iron in this market was featureless throughout the year, but an unusually heavy liquidation of stocks brought an interesting period of low prices for charcoal iron during August. Prices as low as $12.50 for large tonnages and $13 for small lots, f.o.b. furnace, were made. During the past few years, in which much progress has been made in the knowledge of foundry mixtures, the market in which charcoal iron could continue to command the customary premium of $2 over coke iron had narrowed appreciably. Failure to meet this situation resulted in the accumulation of huge stocks of charcoal iron in Michigan, and with the awakening came the realization that the iron could be moved only by underselling foundry and malleable irons. There was no time for education or demonstration then, so the price dropped. During August the average price of charcoal iron at Chicago was $14.69 as compared with $15 for Northern coke iron. This compares with an average price for charcoal iron over the interval of the last 13 years of $19.85. During that same period charcoal iron commanded an average premium of $1.83 over coke iron. The liquidation in August was accordingly made at a sacrifice of $5 a ton from the average price of the last decade and of the entire premium over coke iron.

A PROFITABLE YEAR FOR STEEL MAKERS.

While the year just ended has been one of declining activity and has brought us at its close into what we are pleased to call hard times, it has been a year of record-breaking profits for the makers of steel products. It has been a year when it was possible to observe most interestingly the influence of money and banking upon business, and in the course of events these fundamental influences played no small part. It has been a year when manufacturers and merchants have been able to establish new outposts in their business, new footholds, which will make their maximum business of this year their normal business in the next flood tide. No better example of this can be suggested than the wonderful growth of the business of the jobbers of iron and steel during the period when mill deliveries were most delayed. Though we may be at the foot of the ladder just now, and the bottom rungs be obscured somewhat in legislative darkness, the art of climbing is not lost.

The Cincinnati Iron Trade in 1913

BY CHARLES L. SMITH

The year just ended has been eventful. Early in the spring disastrous floods closed many metal-working plants in southern Ohio, including a number of foundries in Cincinnati and its environs. The rapid recovery of manufacturers and the early resumption of business along normal lines excited the admiration of the country. This forced let-up in activities, however, coupled with the labor troubles which the foundries in Cincinnati experienced later on, naturally cut down the melt of foundry pig iron in this immediate vicinity. From a tonnage standpoint, if basic iron is excluded, the showing for 1913 was not equal to that of the previous year.

With the machine tool trade, irregular conditions prevailed throughout the year. A fairly good export business was booked during the early months, as well as in the fall, when enough domestic orders were received to cause a spurt in activity, which practically ended early in November.

The subjoined table issued by John M. Manley, secretary of the Cincinnati Branch of the National Metal Trades Association, shows the percentage of activity of the local members of this association from January 15, 1907, to December 15, 1913. The

Percentage of Productive Capacity Active in the Cincinnati Metal Trades

Date	Per cent.	Date	Per cent.
June 15, 1907	100	December 15, 1910	91
September 15, 1907	97	March 15, 1911	91
December 15, 1907	85	June 15, 1911	87
March 15, 1908	67	September 15, 1911	85
June 15, 1908	56	December 15, 1911	83
September 15, 1908	53	March 15, 1912	82
December 15, 1908	56	June 15, 1912	84
March 15, 1909	62	September 15, 1912	88
June 15, 1909	65	December 15, 1912	93
September 15, 1909	72	March 15, 1913	97
December 15, 1909	83	June 15, 1913	99
March 15, 1910	89	September 15, 1913	90
June 15, 1910	92	December 15, 1913	95
September 15, 1910	91		

quarter ended June 15, 1907, is taken as a basis, as that period was the most active than Cincinnati manufacturers ever experienced. It will be noted that the figures for the latter part of 1913 were very favorable. This was due to the fact that manufacturers were anxious to clean up all orders on their books as well as make up necessary stocks before the end of the year. At present a fair estimate would hardly run over 50 per cent., based on the number of employees on the payroll.

DECLINE IN PIG-IRON PRICES BEGAN IN JANUARY

The pig-iron market almost steadily declined, beginning early in January, and only a few advances were made during the year. Prices of both Southern and Northern No. 2 foundry are now from $3 to $3.50 per ton lower than they were in December, 1912.

The usual holiday dullness characterized the market early in January, 1913, but in fact little business was done during the entire month. A few Tennessee furnaces were reported as booking some orders for the first quarter on a basis of $13.50, Birmingham, although the general quotation was $14. About the only sale of consequence was made to a pipe manufacturer. The market showed some improvement early in February, with considerable quiet buying of small lots of foundry iron. A number of Alabama furnaces unsuccessfully tried to hold up the market to $14, Birmingham, but later they were compelled to meet competition from Tennessee producers and to reduce their quotation to $13.50. The market dragged through March, with only spasmodic buying, somewhat relieved by a number of orders placed by Indiana melters.

For the first two weeks in April business was almost at a standstill by reason of the irregular railroad service due to the floods that closed many consumers' plants in the Central West. In the latter

part of that month the foundries were actively employed and considerable buying of iron took place on a basis of $12.50, Birmingham, for nearby shipment. Both the Southern and Northern markets experienced a drop in price the first week in May, but this did not bring out much business. The month of May was comparatively dull with all interests. A further reduction in price was made in June, but with the exception of a sale of Northern basic to a nearby steel company little business was transacted. Foundrymen evidently believed that the market had not reached bottom, and a reduction of about 50c. a ton in July was proof of the fact that they were correct in this surmise. A buying movement commenced in August, which included several round tonnages of malleable, although this business had been unexpected during the midsummer.

A BUYING MOVEMENT IN AUGUST

Prices on Southern iron were advanced slightly the first week in August and considerable business was done, both with the gray-iron foundries and malleable-iron makers. The Northern market did not respond to the advances on Southern grades, and the month showed an average decline of 30c. a ton. It was reported that considerable speculative iron had been bought in the South, but these reports were not confirmed. In the first week in September a large consumer of basic iron purchased 50,000 tons for delivery over the remainder of the year and extending through the first half of 1914. It is understood that this purchase was about equally divided between southern Ohio and Lake furnaces. Foundry iron sales were light during the month, but in the face of this several of the leading Southern interests advanced their quotations to $11.50, Birmingham, and in the latter part of September a few of them were asking $12 for future shipment. But $11 iron was obtainable from a number of furnaces and that price was inserted in a few contracts running through the first quarter of 1914. Northern iron continued stationary at $14, Ironton, although it was reported that favored customers were able to contract for their last quarter requirements below this figure.

In October a strenuous effort was made by Southern producers to establish a minimum quotation of $11.50, Birmingham, for last quarter shipment. While not entirely successful, some iron changed hands the first part of the month at this figure, but delivery dates, as a rule, were extended into the first quarter of 1914. Malleable was more active than foundry iron and several sales were made, the largest of which was 2500 tons to an Indiana melter. Toward the latter part of the month some of the Lake furnaces invaded this territory and took business at prices that would figure out below the regular quotation of $14, Ironton, made by the Hanging Rock producers. The furnaces in that locality met this competition and it is understood that a number of quiet deals were made during the latter part of the month. Stagnant business conditions weakened the price of Southern iron and it went back to $11, Birmingham, for shipment through the remainder of the year.

In November both Northern and Southern prices continued to sag and a reduction of 50c. a ton was made in both districts before the close of the month. As is generally the rule, consumers were slow in buying on a falling market, and, with the exception of one large sale of Southern iron reported to have been made, little interest was taken by buyers. In the first two weeks of December further weakness in prices was witnessed and Northern iron was offered freely at $13, Ironton, for either prompt or first half shipment. This price naturally shut out Southern iron from a number of points in the Central West and forced several Southern furnaces to reduce their minimum quotation to a basis of $10.50, Birmingham. Buying was confined almost entirely to those melters who had been holding off and were in actual need of iron.

INVOICE PRICES OF A CINCINNATI IRON MERCHANT

The books of one of the leading local pig-iron firms show the subjoined invoice prices on Southern No. 2 iron, f.o.b. Birmingham, for eleven months of 1913. Of course these figures represent

Invoice Prices f.o.b. Birmingham on Pig Iron Shipped in 1913

January	$13.023	July	11.873
February	13.1125	August	11.1338
March	13.330	September	11.166
April	13.212	October	11.083
May	13.04	November	11.255
June	12.584		

the invoice prices on considerable iron that had been sold the previous year for future shipment, but it is somewhat curious to note that the figure for the month of March was above that of the preceding month. This can be partly accounted for by the fact that considerable carload buying for prompt shipment took place in February at prevailing quotations which, during that month, were higher than the prices quoted in March:

OLD MATERIAL

The scrap-iron market has been one of the most unsatisfactory for all concerned than in a number of years. In January No. 1 railroad wrought was quotable at $11.25 and No. 1 cast at $11. The present quotations are practically $3 a ton below these prices, and at the close of the year there were no stable prices on any grades. The demand gradually slumped through the year and yard stocks at the close were large, with heavy offerings from the railroads.

The following table shows the range of Cincinnati prices throughout the year on leading grades of pig iron and scrap, averaged from weekly quotations in *The Iron Age:*

Average Prices of Pig Iron and Scrap at Cincinnati in 1913

	Southern No. 2, gross ton	Northern No. 2, gross ton	No. 1 railroad wrought, net ton	No. 1 cast scrap, net ton
January	$16.95	$18.00	$11.25	$11.00
February	16.68¾	17.70	10.88¾	10.68¾
March	16.31¼	17.26¼	10.75	10.50
April	15.62½	16.95	10.62½	10.37½
May	15.00	16.20	10.10	9.85
June	14.06¼	15.95	9.68¾	9.43¾
July	13.75	15.50	9.25	9.00
August	14.06¼	15.20	9.25	9.00
September	14.25	15.20	9.18¾	9.00
October	14.35	15.20	9.00	9.00
November	13.87½	14.82½	8.50	8.50
December	....	....	....	....

The Sterling Steel Foundry Company, Braddock, Pa., has increased its capital stock from $293,000 to $313,000.

The annual meeting of the Compressed Gas Manufacturers' Association will be held at 25 Madison avenue, New York, January 29.

Iron and Steel Prices for Sixteen Years

Monthly Averages Computed from the Weekly Market Quotations of "The Iron Age" in the Period 1898-1913

(With Supplement)

Accompanying this issue of *The Iron Age* is our annual chart, in which lines are plotted to indicate the course of prices for pig iron, Bessemer steel billets and some leading forms of finished iron and steel in the 16 years ending with 1913. The diagrams are based on monthly averages of prices quoted week by week in our market reports from the leading selling centers. The table below, which gives the monthly average prices on which the chart is based, includes also the average prices of No. 2 X foundry pig iron at Philadelphia, which have not been put in graphic form.

Bessemer Pig Iron at Pittsburgh, per Gross Ton (2240 lb.)

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
January	$9.87	$10.87	$24.99	$13.15	$16.70	$22.15	$13.91	$16.85	$18.35	$23.15	$19.00	$17.34	$19.90	$15.90	$15.05	$18.15
February	10.05	11.60	24.80	14.43	16.93	21.45	13.66	16.41	18.35	22.85	17.90	16.78	19.34	15.90	14.90	18.15
March	10.39	14.59	24.72	16.31	17.37	21.85	14.25	16.35	18.28	22.85	17.86	16.25	18.60	15.90	15.09	18.15
April	10.41	15.03	24.70	16.75	18.75	21.28	14.18	16.35	18.19	23.35	17.49	15.78	18.27	15.90	15.15	17.90
May	10.30	16.20	21.00	16.30	20.75	20.01	13.60	16.16	18.10	24.01	16.93	15.84	17.52	15.90	15.13	17.70
June	10.34	18.51	19.72	16.00	21.56	19.72	12.81	16.65	18.23	24.27	16.90	16.05	16.60	15.90	55.15	17.14
July	10.25	20.65	16.75	16.00	21.60	18.89	12.40	14.85	18.41	23.55	16.83	16.46	16.40	15.90	15.20	16.70
August	10.35	21.75	15.60	15.75	21.62	18.35	12.81	15.20	19.00	22.90	16.23	17.03	16.09	15.90	15.46	16.52
September	10.78	23.43	13.87	15.75	21.75	17.22	12.63	15.91	19.54	22.90	15.90	18.05	15.90	15.90	16.15	16.65
October	10.36	24.18	13.06	15.89	21.75	16.05	13.10	16.54	20.35	22.00	15.71	19.53	15.90	15.44	17.80	16.60
November	10.15	24.78	13.48	16.00	21.68	15.18	14.85	17.85	22.85	20.65	16.59	19.90	15.82	15.00	18.02	16.02
December	10.58	24.90	13.43	16.31	21.75	14.40	16.65	18.35	23.75	19.34	17.40	19.90	15.90	15.03	18.15	15.77

Bessemer Steel Billets at Pittsburgh, per Gross Ton

January	14.93	16.62	34.50	19.75	27.50	29.60	23.00	22.75	26.25	29.40	28.00	25.00	27.50	23.00	20.00	28.30
February	15.06	18.00	34.87	20.31	29.37	29.87	23.00	23.50	26.50	29.50	28.00	25.00	27.50	23.00	20.00	28.50
March	15.25	24.30	33.00	22.88	31.25	30.62	23.00	24.00	26.70	29.00	28.00	23.00	27.50	23.00	19.75	28.50
April	15.06	25.37	32.00	24.00	31.50	30.25	23.00	24.00	27.00	30.12	28.00	23.00	26.75	23.00	20.00	28.50
May	14.85	26.75	28.90	24.00	32.20	30.37	23.00	23.50	26.40	30.30	28.00	23.00	26.12	22.60	20.80	27.37
June	14.65	30.10	27.25	24.38	32.37	28.87	23.00	22.00	26.63	29.62	25.75	23.00	25.30	21.00	20.87	26.50
July	14.50	33.12	21.00	24.00	31.75	27.60	23.00	22.00	27.25	30.00	25.00	23.50	25.00	21.00	21.50	26.60
August	15.85	35.40	18.20	24.20	31.06	27.00	23.00	24.00	27.80	29.25	25.00	24.13	24.62	21.00	22.12	26.00
September	16.00	38.87	16.93	24.88	29.50	27.00	20.00	25.00	28.00	29.37	25.00	25.00	24.40	20.75	23.62	24.87
October	15.56	38.75	16.50	26.70	29.70	27.00	19.50	25.62	28.00	28.20	25.00	26.25	23.75	20.00	26.00	23.30
November	15.06	36.50	18.95	27.00	28.50	24.00	20.25	26.00	28.88	28.00	25.00	27.13	23.30	19.50	27.00	21.00
December	15.80	33.75	19.75	27.50	29.12	23.00	21.20	26.00	29.50	28.00	25.00	27.50	23.00	19.25	27.00	20.00

Basic Pig Iron, f.o.b. Mahoning or Shenango Valley Furnace, per Gross Ton

January	....	....	....	....	....	....	....	15.46	17.06	21.90	16.90	15.50	16.87	13.25	12.35	16.41
February	....	....	....	....	....	....	....	15.25	16.82	22.00	15.97	15.12	16.31	13.65	12.25	16.30
March	....	....	....	....	....	....	....	15.55	16.85	21.50	15.62	14.94	16.00	13.75	12.81	16.11
April	....	....	....	....	....	....	....	15.06	16.88	21.50	15.25	14.05	15.94	13.75	13.00	15.87
May	....	....	....	....	....	....	....	15.06	17.00	22.90	14.91	14.12	15.19	13.32	13.00	15.15
June	....	....	....	....	....	....	11.76	14.60	16.94	22.40	15.25	14.62	14.70	13.05	13.12	14.50
July	....	....	....	....	....	....	11.20	14.00	17.12	21.75	14.51	15.05	14.50	13.12	13.40	14.37
August	....	....	....	....	....	....	11.69	14.32	17.70	21.25	14.69	15.25	14.12	13.00	13.94	14.06
September	....	....	....	....	....	....	11.60	14.86	18.44	20.06	14.43	15.90	13.70	12.80	14.37	14.00
October	....	....	....	....	....	....	12.19	15.25	19.55	19.50	14.04	16.94	13.15	12.52	15.98	13.90
November	....	....	....	....	....	....	14.00	16.87	21.37	18.12	14.72	17.25	13.25	12.42	16.37	13.09
December	....	....	....	....	....	....	15.70	16.75	21.50	17.50	15.60	17.05	13.40	12.25	16.50	12.71

Southern No. 2 Foundry Pig Iron at Cincinnati, per Gross Ton

January	9.50	10.31	20.69	13.45	14.55	21.65	12.37	16.25	16.75	26.00	16.15	16.25	17.25	14.25	13.25	16.95
February	9.25	11.69	20.50	13.12	14.75	21.50	12.12	16.25	16.75	26.00	15.75	16.13	17.06	14.25	13.31	16.69
March	9.25	13.75	20.30	14.00	14.75	21.37	12.10	16.25	16.65	26.00	15.50	15.05	16.30	14.25	13.50	16.31
April	9.25	14.50	20.19	14.50	16.87	20.15	12.50	16.25	16.63	25.06	15.20	14.25	15.37	14.25	13.75	15.65
May	9.37	14.56	19.75	13.85	18.35	18.87	12.25	15.81	16.75	24.25	14.75	14.50	15.00	13.95	14.15	14.94
June	9.30	16.00	18.75	13.37	20.19	17.75	11.80	14.65	16.44	24.10	15.25	14.70	14.85	13.44	14.25	14.06
July	9.25	17.56	16.81	13.00	20.75	16.15	11.81	13.94	16.06	23.85	15.00	15.75	14.75	13.25	14.70	13.75
August	9.37	18.35	14.25	13.00	23.06	15.19	12.00	14.40	17.30	23.00	15.25	16.38	14.31	13.45	15.06	14.06
September	9.55	19.94	13.62	13.06	25.00	14.75	12.00	14.37	18.69	21.50	15.65	17.35	14.25	13.31	15.87	14.25
October	9.75	20.75	12.87	13.75	25.65	13.50	12.81	15.31	20.00	20.95	15.75	17.88	14.25	13.25	16.80	14.35
November	9.75	20.75	12.95	14.00	23.62	12.00	15.19	16.60	23.38	19.50	16.00	17.75	14.25	13.20	17.25	13.87
December	9.90	20.75	13.75	14.25	22.44	12.05	15.85	16.75	25.00	17.00	16.25	17.45	14.25	13.19	17.25	13.95

Local No. 2 Foundry Pig Iron at Chicago (at Furnace), per Gross Ton

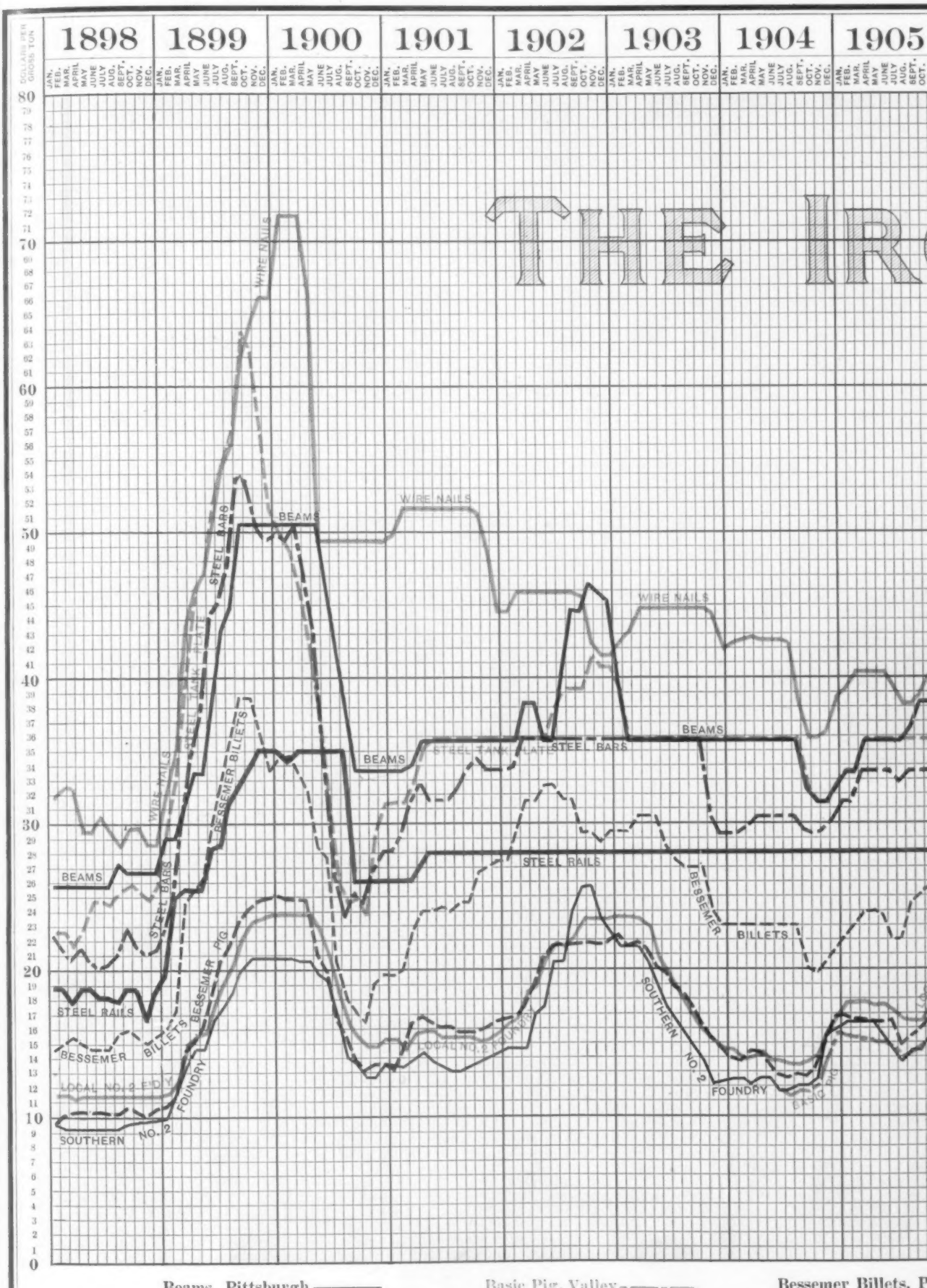
January	11.35	11.47	23.85	15.10	16.25	23.45	14.47	17.85	19.60	25.85	18.45	17.35	19.00	15.50	14.00	17.90
February	11.28	12.47	23.85	14.60	16.85	23.35	13.91	17.85	19.41	25.85	18.16	16.75	19.00	15.50	14.00	17.31
March	11.10	14.95	23.85	15.60	18.51	23.22	14.05	17.80	19.35	26.10	17.85	16.50	18.30	15.50	14.00	17.25
April	11.26	15.47	23.72	15.85	18.97	22.87	14.35	17.60	19.10	26.35	17.73	16.50	17.50	15.00	14.00	17.00
May	11.35	15.72	22.65	15.85	20.85	20.72	13.85	17.60	18.90	26.85	17.63	16.50	17.06	15.00	14.50	16.00
June	11.35	17.95	20.72	15.35	21.85	19.85	13.70	17.00	18.54	26.60	17.73	16.50	16.75	15.00	14.50	15.62
July	11.35	19.22	18.60	15.35	21.60	18.25	13.60	16.47	18.60	25.55	17.55	17.00	16.56	14.87	14.70	14.70
August	11.35	20.65	16.25	15.35	22.10	17.22	13.60	16.60	19.45	24.85	17.35	17.13	16.50	14.50	15.37	15.00
September	11.35	22.22	15.35	15.35	23.35	16.41	13.85	16.60	20.16	24.10	17.05	18.70	16.40	14.50	16.00	15.00
October	11.35	23.35	14.85	15.10	23.35	15.70	14.10	17.66	21.48	22.45	16.85	19.00	16.06	14.46	17.00	15.00
November	11.35	23.45	14.85	15.23	23.35	15.10	15.98	19.15	24.70	20.66	17.10	19.00	16.00	14.09	17.75	14.87
December	11.35	23.85	15.10	15.85	23.35	14.81	16.95	19.60	25.85	18.80	17.35	19.00	16.00	14.00	18.00	14.60

Standard Brands Eastern Pennsylvania No. 2 X Foundry Pig Iron at Philadelphia, per Gross Ton

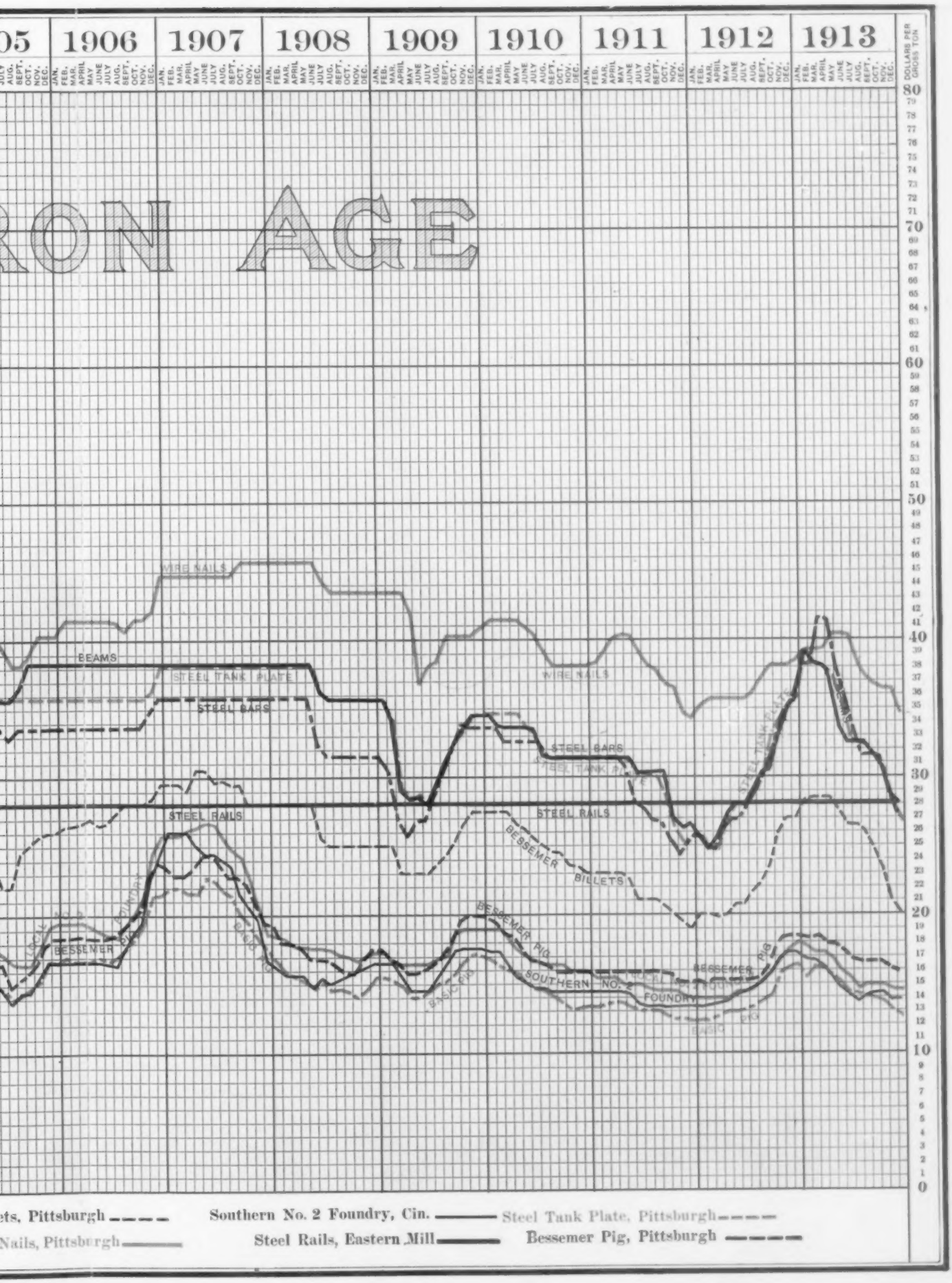
January	10.87	11.44	22.70	15.50	16.75	22.45	14.69	17.50	18.50	24.80	18.25	17.25	19.00	15.50	14.85	18.25
February	10.75	11.06	22.56	15.31	17.19	22.25	14.50	17.50	18.50	25.87	18.25	17.00	18.69	15.50	14.85	18.25
March	10.55	14.70	22.31	15.12	18.81	22.25	14.80	17.56	18.35	25.00	18.12	16.37	18.00	15.50	14.92	17.77
April	10.50	15.75	21.75	15.46	19.62	21.87	15.00	17.75	18.44	24.81	17.65	16.20	17.75	15.50	15.00	17.40
May	10.50	15.81	20.60	15.19	19.75	20.06	14.75	17.81	18.50	25.55	16.94	16.06	17.00	15.50	15.18	16.75
June	10.50	17.25	18.75	15.06	20.94	19.19	14.50	16.75	18.44	24.62	16.62	16.42	16.55	15.25	15.31	16.19
July	10.00	19.44	16.37	15.00	22.30	18.10	14.31	16.12	18.25	23.06	16.50	16.50	16.25	15.00	15.70	15.60
August	10.30	20.65	16.15	14.97	22.00	16.87	14.25	16.25	19.00	21.90	16.50	17.00	16.00	15.00	15.87	15.60
September	10.75	22.75	15.56	14.80	22.00	16.12	14.25	16.43	20.44	20.50	16.62	18.05	16.00	15.00	16.59	15.83
October	10.75	22.75	15.00	15.25	22.12	15.20	14.43	17.25	21.12	19.85	16.75	18.69	15.81	15.00	17.60	15.95
November	10.87	23.40	15.35	15.37	23.37	15.00	15.75	18.05	23.30	18.94	17.00	19.00	15.68	14.95	18.25	15.56
December	11.06	23.25	15.62	15.75	23.00	15.00	16.90	18.25	24.00	18.84	17.25	19.00	15.50	14.85	18.25	15.30

Soft Steel Bars at Pittsburgh, in Cents per Pound

January	0.99	1.02	2.22	1.25	1.50	1.60	1.30	1.40	1.50	1.60	1.60	1.40	1.50	1.40	1.15	1.70
February	0.95	1.12	2.21	1.30	1.51	1.60	1.30	1.40	1.50	1.60	1.60	1.35	1.50	1.40	1.12	1.70
March	0.93	1.36	2.25	1.40	1.60	1.60	1.33	1.50	1.50	1.60	1.60	1.20	1.45	1.40	1.10	1.85
April	0.95	1.56	2.10	1.47	1.60	1.60	1.35	1.50	1.50	1.60	1.60	1.15	1.45	1.40	1.16	1.84
May	0.92	1.67	1.91	1.41	1.60	1.60	1.35	1.50	1.50	1.60	1.60	1.19	1.45	1.37	1.20	1.70
June	0.96	1.98	1.52	1.40	1.60	1.60	1.35	1.46	1.50	1.60	1.45	1.20	1.45	1.25	1.20	1.60
July	0.91	2.02	1.19	1.40	1.60	1.60	1.35	1.50	1.50	1.60	1.40	1.27	1.45	1.23	1.25	1.50
August	0.94	2.14	1.05	1.44	1.60	1.60	1.35	1.50	1.50	1.60	1.40	1.32	1.40	1.20	1.30	1.40
September	1.02	2.40	1.12	1.50	1.60	1.60	1.31	1.50	1.50	1.60	1.40	1.39	1.40	1.19	1.37	1.40
October	0.97	2.39	1.09	1.53	1.60	1.60	1.30	1.50	1.50	1.60	1.40	1.51	1.40	1.12	1.45	1.39
November	0.94	2.24	1.18	1.50	1.60	1.37	1.31	1.50	1.54	1.60	1.40	1.50	1.40	1.08	1.55	1.29
December	0.95	2.20	1.25	1.50	1.60	1.30	1.34	1.50	1.60	1.60	1.40	1.50	1.40	1.12	1.60	1.21



Fluctuations in the Prices of Crude and F
to January 1, 19



Finished Iron and Steel from January 1, 1898, 1914—Gross Tons

Tank Plates at Pittsburgh, in Cents per Pound

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
January	1.00	1.30	2.22	1.40	1.60	1.75	1.60	1.50	1.60	1.70	1.70	1.60	1.55	1.40	1.15	1.75
February	1.00	1.47	2.17	1.40	1.60	1.60	1.60	1.50	1.60	1.70	1.70	1.52	1.55	1.40	1.11	1.71
March	0.97	1.75	2.03	1.47	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.30	1.55	1.40	1.12	1.70
April	1.02	2.05	1.87	1.57	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.27	1.55	1.40	1.21	1.68
May	1.10	2.12	1.69	1.60	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.29	1.51	1.39	1.25	1.60
June	1.10	2.32	1.39	1.60	1.69	1.60	1.60	1.60	1.60	1.70	1.62	1.25	1.48	1.35	1.25	1.45
July	1.09	2.45	1.16	1.60	1.75	1.60	1.60	1.60	1.60	1.70	1.60	1.33	1.41	1.35	1.30	1.45
August	1.12	2.55	1.09	1.60	1.75	1.60	1.60	1.60	1.60	1.70	1.60	1.40	1.40	1.34	1.35	1.44
September	1.15	2.85	1.11	1.60	1.75	1.60	1.44	1.60	1.60	1.70	1.60	1.46	1.40	1.29	1.47	1.40
October	1.12	2.79	1.07	1.60	1.84	1.60	1.40	1.60	1.60	1.70	1.60	1.50	1.40	1.17	1.53	1.36
November	1.11	2.52	1.31	1.60	1.82	1.60	1.40	1.60	1.62	1.70	1.60	1.54	1.40	1.13	1.59	1.26
December	1.16	2.30	1.39	1.60	1.82	1.60	1.45	1.60	1.70	1.70	1.60	1.55	1.40	1.15	1.60	1.20

Beams at Pittsburgh, in Cents per Pound

January	1.15	1.30	2.25	1.50	1.60	1.80	1.60	1.50	1.70	1.70	1.70	1.60	1.55	1.40	1.15	1.75
February	1.15	1.30	2.25	1.50	1.60	1.60	1.60	1.50	1.70	1.70	1.70	1.52	1.51	1.40	1.11	1.71
March	1.15	1.40	2.25	1.52	1.70	1.60	1.60	1.60	1.70	1.70	1.70	1.30	1.50	1.40	1.15	1.70
April	1.15	1.50	2.25	1.60	1.70	1.60	1.60	1.60	1.70	1.70	1.70	1.27	1.50	1.40	1.21	1.68
May	1.15	1.50	2.25	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.70	1.27	1.50	1.39	1.25	1.50
June	1.15	1.70	2.07	1.60	1.60	1.60	1.60	1.60	1.70	1.70	1.62	1.25	1.48	1.35	1.25	1.45
July	1.15	1.94	1.90	1.60	1.84	1.60	1.60	1.60	1.70	1.70	1.60	1.33	1.41	1.35	1.30	1.45
August	1.21	2.05	1.74	1.60	2.00	1.60	1.60	1.63	1.70	1.70	1.60	1.40	1.40	1.35	1.35	1.45
September	1.20	2.25	1.50	1.60	2.00	1.60	1.44	1.70	1.70	1.70	1.60	1.46	1.40	1.34	1.42	1.41
October	1.20	2.25	1.50	1.60	2.07	1.60	1.40	1.70	1.70	1.70	1.60	1.50	1.40	1.21	1.48	1.37
November	1.20	2.25	1.50	1.60	2.05	1.60	1.40	1.70	1.70	1.70	1.60	1.54	1.40	1.13	1.57	1.29
December	1.20	2.25	1.50	1.60	2.00	1.60	1.44	1.70	1.70	1.70	1.60	1.55	1.40	1.15	1.60	1.25

Wire Nails at Pittsburgh, per Keg of 100 lb.

January	$1.42	$1.43	$3.20	$2,22	$1.99	$1.89	$1.89	$1.75	$1.85	$2.00	$2.05	$1.95	$1.85	$1.71	$1.57	$1.75
February	1.45	1.57	3.20	2.30	2.05	1.92	1.90	1.80	1.85	2.00	2.05	1.95	1.85	1.75	1.60	1.75
March	1.43	1.94	3.20	2.30	2.05	2.00	1.91	1.80	1.85	2.00	2.05	1.95	1.85	1.79	1.60	1.76
April	1.31	2.05	2.95	2.30	2.05	2.00	1.90	1.80	1.85	2.00	2.05	1.87	1.85	1.80	1.60	1.80
May	1.31	2.10	2.20	2.30	2.05	2.00	1.90	1.80	1.85	2.00	2.05	1.65	1.82	1.80	1.60	1.80
June	1.35	2.30	2.20	2.30	2.05	2.00	1.90	1.74	1.85	2.00	1.97	1.70	1.80	1.75	1.60	1.80
July	1.31	2.42	2.20	2.30	2.05	2.00	1.89	1.70	1.84	2.00	1.95	1.72	1.76	1.70	1.62	1.70
August	1.26	2.50	2.20	2.30	2.05	2.00	1.71	1.70	1.82	2.00	1.95	1.80	1.70	1.69	1.66	1.65
September	1.32	2.76	2.20	2.30	2.03	2.00	1.60	1.74	1.86	2.05	1.95	1.80	1.70	1.65	1.70	1.65
October	1.33	2.87	2.20	2.28	1.89	2.00	1.60	1.80	1.85	2.05	1.95	1.80	1.70	1.64	1.70	1.63
November	1.28	2.95	2.20	2.17	1.85	1.97	1.62	1.80	1.88	2.05	1.95	1.80	1.70	1.55	1.70	1.59
December	1.27	2.95	2.20	1.99	1.85	1.87	1.73	1.80	2.00	2.05	1.95	1.85	1.70	1.53	1.72	1.55

In plotting the lines on the chart, those representing finished material have been derived by multiplying the market prices of finished material per pound by 2240, so that the traversing lines would show the exact price relation between gross tons of all products. In the above tables, however, while pig iron and steel billet prices are in dollars per gross ton, those for finished material are stated in the usual way—namely, in cents per pound.

The period covered begins with 1898, the year in which the depression following the panic of 1893 reached its culmination in its disastrous effect upon iron and steel prices. In 1899 came rapid advances, as demand matured which the capacity of the country was inadequate to supply. The high peak of that year is the spectacular feature of the chart. Almost as striking in the other way are the declines of 1900. In 1901 prices were fairly steady, with advances in the latter part of the year, bringing another series of high points in 1902, though these are moderate in comparison with 1899. The sharp decline of 1903 is distinctly shown; the slight further decline extending over nine months of 1904, with advances in the latter part of the year; some reaction in 1905, followed by advances in the latter part of the year and a comparatively stable level for the first half of 1906. Then came a strong movement upward, until substantially the levels of 1902 were reached, followed by recessions after the middle of 1907. The cooperative movement among steel manufacturers modified the decline in the depression of 1908 and in the spring of 1909 came some abrupt declines in response to the insistence of some steel manufacturers, particularly of bars, that prices had been kept too high. These cuts stimulated buying and gave the strong upward curve of the second half of 1909. In general, 1910 was a year in which the price movement reversed that of 1909, pig iron reaching again its low points of 1909, while finished materials only retraced part of the distance to the bottom touched after the open market declaration of February, 1909. Steadily declining prices marked 1911. The break in finished material in May is plainly indicated in the pitch of the curves. November was the low month of the year and there was a slight recovery in December. Early in 1912, however, active competition developed a further decline and the low point for the year was touched in February in some products and in March in others. Gradually rising prices marked the late spring and summer and fall months, and on contract material the last three months of that year showed little change. The high prices paid for early deliveries were a prime feature of the first four months of 1913. In May prices for early and for future delivery came closer together and by June premiums on prompt steel had practically disappeared. Business fell off as the summer advanced and in the last four months of the year price declines became marked.

Prices used in plotting the charts are those asked by producers for delivery in from one to three months and thus do not represent the extreme prices paid at times, as in late 1912 and early 1913. for prompt delivery.

La Follette Receivership.

Neill Robinson was appointed at Knoxville, Tenn., December 23, as receiver for the La Follette Coal, Iron & Railway Company, La Follette, Tenn. The petition was filed by the Electric Corporation of Maine, to which, according to the bill, the La Follette company is indebted in the sum of $3,129,075 on bonds and notes, and $30,000 for cash advanced in September. The head of the La Follette Coal, Iron & Railway Company is H. M. La Follette. A State bank, a store and hosiery mills were also involved in the failure. It should be stated that the La Follette Iron Company is an entirely separate corporation. It has a lease of the blast furnace, coke ovens, stone quarry and iron mines of the La Follette Coal, Iron & Railway Company, and is operating these for itself. The lease has still six years to run and is not affected by the receivership. The La Follette Iron Company has been a buyer of coal from the La Follette Coal, Iron & Railway Company. The future extent of coal mine operations has not been decided.

The Semet-Solvay Company has removed its New York City office from 100 William street to the Forty-second Street Building, corner of Madison avenue and Forty-second street. O. S. Doolittle is New York representative.

S. DIESCHER & SONS
Mechanical and Civil Engineers,
PITTSBURGH, PA.

Metal Market Features of 1913

BY CHARLES LUNDBERG

The appended table gives a comparison of prices quoted for the principal nonferrous metals in New York on January 1, 1912, January 1, 1913, and December 23, 1913. It shows that all the quotations of December 23 were substantially below those of January 1, this year, but that Lake and electrolytic copper were higher on December 23 than they were on January 1, 1912, while tin, lead and spelter were lower when compared with the beginning of 1912:

Prices in New York on Jan. 1, 1912, and Jan. 1 and Dec. 23, 1913

	Lake. Cents	Electrolytic. Cents	Tin. Cents	Lead. Cents	Spelter. Cents
Jan. 1, 1912...	14.25	14.12½	44.25	4.45	6.35
Jan. 1, 1913...	17.75	17.62½	50.65	4.30	7.30
Dec. 23, 1913..	14.62½	14.37½	36.62½	4.00	5.15

COPPER

The trend of copper in 1913 was almost steadily downward. The monthly statistics of the Copper Producers' Association throughout the greater part of the year were of a nature to strengthen prices, inasmuch as they showed repeated and large decreases in stock, but other influences lessened their effect in this direction. The following table shows the stock of marketable copper in producers' hands at the dates mentioned:

Domestic Surplus Stock

	Pounds		Pounds
December 1, 1912	86,164,059	July 1, 1913.....	52,904,606
January 1, 1913.	105,312,582	August 1, 1913...	53,594,945
February 1, 1913	123,198,332	September 1, 1913	38,314,037
March 1, 1913...	122,302,198	October 1, 1913..	29,793,094
April 1, 1913....	104,269,270	November 1, 1913	32,566,382
May 1, 1913.....	75,549,108	December 1, 1913	47,929,429
June 1, 1913.....	67,564,225		

The low point in stock, as will be observed, was on October 1, when 29,793,094 lb. was reported. Late in the year deliveries for export held up better than those for domestic consumption. In November, for instance, the domestic deliveries were 48,656,858 lb., as against deliveries for export amounting to 70,067,803 lb. Long before this month the demand for brass and copper products had slowed down and many of the mills had gone on four and five day time per week.

January was marked by the record production for that month of 143,479,625 lb., which caused an increase of 17,885,750 lb. in stock. Lake was quoted January 1 at 17.75c. and electrolytic at 17.62½c. The Lake price December 23 was 3.12½c. lower and that of electrolytic 3.25c. lower than on January 1. Stock in February decreased 896,134 lb., which marked the beginning of a steady dwindling, to last until October. It was the first decrease since the previous August. A decrease in stock was expected in March, but that it would fall off 18,032,928 lb. occasioned surprise. In April the stock decrease was 28,720,162 lb. In June domestic deliveries fell off over 12,000,000 lb., but production in the same month fell off about 19,500,000 lb., and at the end of the month there was a decrease in stock of over 14,500,000 lb. The lessened production of June was in part due to a strike at the Nichols refinery on Long Island. In July domestic deliveries fell off about 10,000,000 lb., while foreign deliveries increased about that amount. The world's visible supply of stock on October 1, when the United States surplus was about 29,793,094 lb., was about 41,119 tons, the lowest since the first publication of the American copper reports five years ago, the world total being obtained from the figures of the Copper Producers' Association combined with those of Henry B. Merton & Co., London, England. The following table shows the United States production and the deliveries, domestic and for export, for 1912 complete and for 11 months of 1913, as gathered by the Copper Producers' Association, in pounds:

	Production	Domestic deliveries	Deliveries for export
Total for 1912.....	1,581,920,287	819,665,947	746,396,452
January, 1913.....	143,479,625	65,210,030	60,383,845
February, 1913.....	130,948,881	59,676,492	72,168,523
March, 1913.....	136,251,849	76,585,481	77,699,306
April, 1913.....	135,333,402	78,158,837	85,894,727
May, 1913.....	141,319,416	81,108,321	68,285,978
June, 1913	121,860,853	68,452,571	68,067,901
July, 1913.....	138,074,602	58,904,192	78,480,071
August, 1913.....	131,632,362	73,649,801	73,263,469
September, 1913....	131,401,229	66,836,897	73,085,275
October, 1913.....	139,070,481	68,173,720	68,123,473
November, 1913....	134,087,708	48,656,858	70,067,803

In 11 months of 1913 the total of copper exports from the United States, as compiled by Secretary C. Mayer of the New York Metal Exchange, was 352,157 tons, as compared with 298,491 tons in the same period of 1912. In 1913, up to December 1, Germany took 134,585 tons, as against 107,172 tons in the same period of 1912. Exports in previous years (12 months of each) were 327,965 tons in 1912, 336,801 tons in 1911, 301,935 tons in 1910 and 301,657 tons in 1909.

Some unusual or otherwise interesting features of the other metals were the following:

TIN

On December 23 tin was quoted at 37.75c., or 14.02½c. below the price on January 1. The average price paid in January by a steady purchaser was 50.30c. In January, 1912, the same buyer paid an average of 43.25c. As in copper, the almost steady tendency of prices was downward, but at or near the top notch price a big business was done; in fact, consumers overloaded, being actuated by reports that the price was going to 55c. When the market took the other course buyers became bitter and condemned the tactics which caused them to buy heavily when they did. Their distrust lasted many months. In March 320 tons of Chinese tin arrived in New York. Deliveries into consumption in that month reached the record-breaking total of 5900 tons, the nearest previous high figure having been 5400 tons in April, 1912. In June 100 tons of Banca tin, for which a market could not be found, was returned to Europe. June was an active month in a speculative way in London, and in four days London declined £12. The next few months were uneventful except that deliveries on contracts were heavy, and when the general slackening up of business came, late in the year, consumers found that small purchases added to what metal they had carried oversupplied their needs. Banca tin was sold at auction in Holland, January 29, at 137¼ florins, equal to 50c. c.i.f. New York. On November 27 a similar sale brought 109¾ florins, equal to 40c. c.i.f. New York. Deliveries in 1913 were as follows, in tons:

January	3700	May	3350	September ...	3100
February ...	3500	June	3800	October	3700
March	5900	July	3900	November ...	2800
April	3450	August	3600		

The total visible supply December 1, 1913, was 14,470 tons, as against 12,348 tons December 1, 1912. In the 11 months of 1913 deliveries were 4650 tons less than in the same period of 1912.

LEAD

The price at New York on December 23 was 4c., or 30 points below that of January 1. The progress of tariff revision exerted a considerable influence on lead during most of the year. It is conceded that the reduced duty will prevent prices from soaring in the future. Business was good until November, when buying slowed up and independent producers competed vigorously for such business as appeared. They met and cut repeatedly the reductions of the American Smelting & Refining Company and the competition brought the price down on December 10 to 4c., New York. The lead supply was curtailed in August by a strike in the Missouri lead fields. It was declared on August 15, and on that day the American Smelting & Refining Company withdrew from the market for a few hours, then announced an advance in price from 4.50c. to 4.75c., New York.

SPELTER

Between January 1 and December 23, 1913, the market lost 2.15c., dropping from 7.30c. to 5.15c., New York. In January German spelter was sold at or near 7.05c. on the Atlantic seaboard. In September foreign spelter was offered again in the New York market, but consumers did not take it readily, preferring the domestic metal, with the qualities of which they were more familiar.

ANTIMONY

When 1913 opened Cookson's was selling at 9.75c., Hallett's at 9.37½c. and Chinese and Hungarian grades at 9c. December prices were about 7.40c. to 7.50c. for Cookson's, 7c. to 7.25c. for Hallett's and 6c. to 6.50c. for Chinese and Hungarian grades. There were few special features in the metal aside from the overbought condition in the early part of the year, and later the accumulation of a vast store, which report said was 4,500,000 lb. or enough for a year's consumption, in bonded warehouses awaiting a lower rate of duty. When this metal was released the market became glutted.

ALUMINUM

Prompt delivery domestic aluminum began the year at about 26.50c. and late in December was quoted at 18.50c. to 19c. Each month saw declines in prices and, as in antimony, a vast quantity was held in bonded warehouses awaiting the enactment of the new tariff. Demand for the metal suffered to a great extent in the later months of the year from the lighter, or at least deferred, buying on the part of automobile manufacturers.

Changes and Outlook in the Lake Iron-Ore Trade

BY DWIGHT E. WOODBRIDGE

The year, which opened so auspiciously, entered a cave of gloom a month or two before the close of navigation on the lakes, and shipments barely met the mark of 50,000,000 tons, set early in the season by most operators. When the returns come in from all-rail shipments to furnaces, and if to these are added the movement from mines on the Canadian side of Lake Superior and Georgian Bay, whose production is directly competitive with that from the American side of the lakes, it will be found that the total for the year is almost precisely 50,000,000 tons. This is an increase, albeit a moderate one, over the best preceding year in the history of the Lake iron-ore trade. That shipments will continue to double every few years as they have been wont to do in the past is too much to expect, but that they will continue to advance with the growth of the nation and its trade is not to be questioned. That Lake Superior mines will be called upon, in a relatively few years, to supply 60,000,000 and then 70,000,000 tons a year is unquestionable.

AMOUNT OF DEVELOPED ORE.

The figures of the Minnesota Tax Commission indicate a developed tonnage in the State amounting to about 1,700,000,000 tons of merchantable ore, of which some 300,000,000 tons has not yet been entered as taxable. Tax figures for Michigan and Wisconsin indicate a combined total developed there of about one-tenth as much. Were this all the ore to be expected from the Lake Superior field its future could be figured with considerable precision. But there is no probability that any district yet opened has exposed all its ultimate tonnage to the drill. Even on the Mesaba, where exploitation is easier than elsewhere, it is probable that far more than the 1,390,000,000 tons returned will be found to exist. So far as the older and geologically more complicated ranges are concerned, their exploitation has scarcely begun.

A GREAT PROSPECT.

In any review of the past year in the Lake Superior iron ore region one broad fact stands preeminent. That fact is the vastness of Lake Superior ore reserves and the long productive future that lies ahead of the region.

I recall the time, some seven or eight years ago, when T. F. Cole was still president of the Oliver Iron Mining Company, that he appeared before some legislative committee of Minnesota to discuss a proposed change in the method of taxing iron ores. In the course of his argument he then said that a contemplation of the great geological syncline of Lake Superior, with its Keewatin, its upper Huronian outcropping from the vicinity of Marquette to points west of the Mississippi River, its lower Huronian outcropping to the south of the southerly and to the north of the northerly exposures of the upper, and with its Laurentian rocks still further down in the series; with its copper-bearing formations on both sides of Lake Superior, following by its soft hematites, and these in turn by its hard ores, likewise on both sides the lake—all pointed to great westward extensions and to great depths of the then mined portions of the region. I quote from memory and simply as those remarks impressed me, but think that I quote with reasonable correctness.

This was when knowledge of the Cuyuna range was rudimentary and when the development of the great ranges to the south of the lake, the Marquette, Menominee and Gogebic, was in what are now known to have been high levels. Today experience is bearing out these prophetic theories, and the great fact of the past year or two is that these broad views were based on sound reasoning.

MUCH ORE AT GREATER DEPTH.

It is now known that a vast area is underlain by the rocks of the Cuyuna district, and ore has been found in this formation to points in Morrison County, 125 miles west from Duluth. It would appear that the extent and the quantities of low-grade iron material distributed over this region point to larger concentrations of merchantable ores than are now known there and at lower depth than have yet been opened in the district. As to the old ranges, south of the lake, it is now recognized that mining operations on the Marquette, Menominee, and Gogebic ranges have been for fifty years only in the upper portions of the great areas of ore-bearing rocks of the region. Records of numerous drill holes can now be correlated that show this to be the situation. Within the past year hundreds of feet of solid ore bodies whose summits lie more than half a mile below the surface have been cut by the drill, and, although isolated drill holes do not prove mines, there can hardly be masses of ore hundreds of feet in vertical thickness lying in these deep folds that are not representative of very material additions to the tonnages of the region. The fact in connection with some of this work that is more striking, though of less geological importance, is that one of the most successful deep holes is on a property that was opened more than 60 years ago, and which has been mined more or less continuously during all that period.

Generations will pass before the ores of these older ranges are exhausted, and the relative importance of the various mining districts of Lake Superior, as to their probable tonnage, is undergoing modification.

The question follows, if these results are shown by work in the ore-bearing formations on the south side of the lake, why may not something similar be looked for from these rocks on the northern limb of the syncline? Why may there not be equivalent depth and extension in rocks of like character and age stretching along the north side of Lake Superior, both in the United States and Canada?

LAKE ORES BY WATER TO NEW YORK.

Changes are impending in the economics of the iron ore trade, and the progress of the past year in various parts of the country is bringing them and their meaning home to operators. While the completion of the Panama Canal cannot be expected to bear especially on the ore trade of Lake Superior, for the Allegheny mountains still interpose their barrier and limit the distances in which Lake ore can successfully meet that from abroad, another great canal project has a more direct bearing. By the New York barge canal there will be unrestricted passageway, perhaps sometimes in unbroken bulk, from the Lakes above Niagara to the sea, and Lake ore will be able to reach New York at a cost for transportation as low as, if not less than, it can get to Pittsburgh. If Lake ore can be carried in unbroken bulk from mines to New York harbor the barrier of the mountains will be leveled so that the point of neutral prices between interior and foreign ores will be removed far to the eastward. This canal will soon be in operation.

WASHING, DRYING AND CALCINING.

Among other changes that are impending are those resulting from selective mining and from the introduction of methods of beneficiation of lean ores, existing in great quantity but now unavailable. The Lake region, in common with other parts of the United States, has an unknown but vast quantity of ores suitable for treatment by various methods of hydro, magnetic and initial caloric metallurgy and various plants are now in operation using one or another of these principles. The result of washing sandy Mesaba ores has been frequently referred to. It bids fair to extend in practice during the next year or two. This year several hundred thousand tons of wet Mesabas have been reduced in moisture to a point where there has been a perceptible saving in freights and a considerable raising of the metallic content of the ores. Other works of the same type are in contemplation for this drying operation.

After material modifications and considerable experiment the calcining of siderite ore has been accomplished on an economical scale, and the Algoma Steel Corporation is now enlarging its experimental plant by the addition of five units, which will be ready next spring. The process is a roasting one, using the ordinary rotating kiln and firing with powdered coal. The ore is brought from about 40 per cent. up to 52 or 54 per cent., and is hard, porous and self-fluxing, as it carries a net excess acid base of about nine units, with a combined silica and alumina of about 7.50 per cent. and combined lime and magnesia of some 16.75 per cent. A considerable tonnage has been put through the Grondal magnetic separating works at Moose Mountain, and experiments have been carried out with other low-grade magnetic ores of the Lake region that indicate that this process can be widely extended.

A GOGEBIC STEAM-SHOVEL MINE.

A good deal of iron ore has been developed during the year, especially on the Cuyuna, Gogebic and Menominee ranges. This quantity materially exceeds the shipments of the year. Although not greatest in tonnage, the developments of the year on the Gogebic and Marquette ranges are of more general interest to the iron trade than those elsewhere in the Lake district, and this chiefly because of the type of ore found and the bearing that these discoveries may have on the future of the region. For not only has there been opened a steam-shovel mine on the Gogebic, but deep work in several properties that had formerly been thought practically exhausted has revealed the existence at unprecedented depths of great ore bodies of good grade. Operators are now coming to the belief that no one can foretell the depths to which merchantable ore may continue on those ranges. And if this is acknowledged for the Marquette, why not for other deep-seated formations of the Lake district? Work at several mines belonging to the Schlesinger companies on the Gogebic, and to the Cleveland-Cliffs and Oliver companies on the Marquette, have been especially noteworthy in this respect. At Wakefield the break in the Gogebic formation that had been prospected more or less by many concerns and at various times, finally resulted, a year ago, in the discovery of ore of Gogebic standard type, within a few feet of the surface, and the firm of M. A. Hanna & Co. has this year stripped a property and mined about 20,000 tons therefrom, most of which has been sent to market. The tonnage that has been developed by this and other operators adjoining is not stated, but that it is very large is well known. This property is the first and only pit to be worked on the Gogebic since Joseph Sellwood opened the old Colby in 1882.

CUYUNA MANGANIFEROUS ORE.

Figures seem to indicate that there are now practically developed on the Cuyuna range more than 300,000,000 tons of ore, most of which is merchantable. But included in this total are some

50,000,000 tons, more or less, of a puzzling type of manganiferous ore, puzzling from the general question as to what can be done with it in the present state of the iron trade, although several cargoes have been shipped and have, so far as is known, been accepted and utilized. This ore varies from, say, 50 to 55 per cent. iron, 10 to 15 per cent. manganese, or 55 to 60 per cent. combined, and is about 0.3 per cent. phosphorus. Just what uses this can be put to, in any considerable quantity, is not generally understood. What manganiferous ore shipments have been made from the district have been somewhat higher in manganese and lower in phosphorus than the foregoing averages. Most people believe that these ores have inherent values and will come into use, but just how and when they do not pretend to state. Exploring in this district continues actively; many drills are at work, several shafts are going down and much stripping is under way on ore bodies that have been explored in the past. Stripping on the Cuyuna presents few difficulties, as the overburden is largely sand, with few boulders of coarse material.

During most of the year, also, exploration was active in the Menominee district, and results there have been satisfactory so far as the gross tonnages discovered are considered. Several large deposits have been brought in. Reference has been made elsewhere to the results of work in the Gogebic and Marquette country. Little new ore has been found on the Mesaba, while Vermillion exploration has lagged, with one property near Ely and one north of Vermillion Lake as the only explorations where favorable conclusions yet seem warranted. At the present time a little work is under way in west central Wisconsin, said by the newspapers to be by the Oliver Iron Mining Company.

HYDRAULIC STRIPPING

Several advances in methods may be referred to here. One of these is the beginning of the use of mining machines for underground work, which have been tried in Mesaba mines. For many years the actual winning of ore from its bed has remained a hand operation, and there has been little or no advance in the system in general. Machinery for caring for the ore after it has left miners' hands has been increased in power and improved in efficiency, while hand labor has become more and more inefficient. It is too soon to give any report of results, but it is expected that the quantity of ore won per man underground will be enlarged.

Hydraulic stripping has been inaugurated at the Rowe mine, Cuyuna range, and it has proved on account of the sandy overburden that the theory of working off the ore cover by water is tenable, although the Rowe operation has been beset by various temporary difficulties. The material to be removed is washed loose by a giant and lifted from a sump by a sand pump having a 12-in. diameter. More than 600,000 yards of sand has been taken from this property during the past year, about 85 per cent. of it by the sand pumps. Hydraulic stripping has also been inaugurated by the Jones & Laughlins Steel Company at a property near the Mississippi River, on the western Mesaba range, where an option is held for a large tonnage of what is supposed to be washable ore. This operation is on a more elaborate scale than at the Rowe, for the plant represents an investment of not far from $50,000, and it is said to be making costs that no steam shovel operator has yet been able to approximate. But comparisons are hardly fair, for most of the steam shovel stripping jobs are in a class of material that hydraulic pumps or dredges cannot handle. Nevertheless the experiment undertaken at the Rowe will have an important effect in modifying Lake Superior practice of handling material.

SOME NOTABLE WORK

What appears to be the most notable individual achievement of the year in a mining way is the stripping of 1,400,000 yards of overburden and the mining of 100,000 tons of ore out of the open pit formed by that stripping at the Pennington, in a term that began with February 1 and ended just ten months later. Two steam shovels were used most of the season in the overburden and one in ore late in the year. Another notable piece of work was the mining of almost 6,000,000 tons from the Great Northern lands under lease to the Oliver Iron Mining Company, and another the washing in one day of 8223 tons of ore in the Nashwauk concentrator, a plant built for 5000 tons per day. This concentrator treated 947,548 tons of washable ore during the season. The larger concentrator at Coleraine has washed more than 2,500,000 tons during its season.

Electrical equipment is being installed at many mines each year; the use of concrete for shaft lining is now common; the wood headframe is now an anachronism as is the wood ore shipping pier; water power is being developed for mine uses, especially on the Marquette and Menominee ranges; and there is a very general advance in the installation of safety devices at mines, in which the Lake iron district was already far in the lead of any mining regions of the United States.

GREAT NORTHERN ORE

Great Northern minimums this year amounted to 5,250,000 tons, and the shipments from this lease have been in excess of that amount. There is but one year more remaining for this lease and the Oliver Iron Mining Company is preparing other mines from which it will take the large tonnages now drawn from the Great Northern lands. It is opening several mines to this end. On the other hand, the Great Northern is opening mines from which it will produce a tonnage to maintain its ore traffic, and dividends upon its certificates. Three of these mines are well on toward the state where production might begin, and it is possible that small shipments may be made this year. Another deposit, the very large ore body lying in section 16-56-23, belonging to the State public school fund and under lease to the Great Northern, is being developed by a shaft and will be thoroughly drained before mining is undertaken. It has been found that predrainage of Mesaba overburdens assists shaft-sinking or stripping materially and it will be more and more the fashion, doubtless, to arrange for drainage before exploitation begins.

GREAT MESABA CAVERNS

The drain of the 34,000,000 tons mined from the Mesaba during the year has been shown by the augmentation of the series of canyons that lie along the district and by the announcement of the abandonment of several properties, though these are dropped for the most part for other causes than the exhaustion of the deposits. On the Vermillion a little ore has been mined from the old Chandler, abandoned by the original lessee in 1907 after a production of some 10,000,000 tons, and a little more may be secured from scramming operations. But the exhaustion of the Chandler does not mean the depletion of its deposit for this extends into adjoining leases which are among the chief high

grade shippers of the Lake region and doubtless will so continue for a long time, judging from experience with other deposits.

Shipments from the Cuyuna district for the year amounted to 727,000 tons, or more than twice those of the preceding season, and they bid fair to make another big step forward in 1914. A number of large consuming companies have entered the Cuyuna, these including Rogers, Brown & Co., the Pittsburgh Steel Company, the Inland Steel Company, Tod, Stambaugh & Co., Jones & Laughlins, and to the extent of the ore they may secure from this district they will relieve the general merchant market. These, with the Great Northern one to be released from the Steel Corporation agreement and with the ore of such concerns as Longyear & Bennett, will add greatly to the amount of merchant ore coming on the general market in the next year or two, and in order that the price of ore be maintained during that time there must be an active general trade condition. The belief now is that ore requirements for 1914 may be less than those of 1913, and that prices for the year will be on a lower plane. But so many factors that are now indefinite enter into the course of the iron market for the coming year that it is hard to make any prediction worthy the name.

THE YEAR'S MOVEMENT

Shipments for the year, by lake from American ports, are as follows for the past two years in gross tons:

	1913	1912	Increase
Escanaba	5,399,444	5,234,655	164,789
Marquette	3,137,617	3,296,761	*159,144
Ashland	4,338,230	4,797,101	*458,871
Duluth	12,331,126	10,495,577	1,835,549
Superior	13,788,343	14,240,714	*452,371
Two Harbors...	10,075,718	9,370,969	704,749
	49,070,478	47,435,777	1,634,701

* Decrease.

Receipts at Lake Erie ports for the year amounted to about 40,000,000 tons, the remainder of the shipments having been taken at other points along the lakes, notably Gary and South Chicago. There were some 800,000 tons less ore on lower lake receiving docks at the close of navigation than at the corresponding period the previous year; this was not due to increased demand but to greater facilities at some of the furnaces. Shipments from these docks to consumers are not as active now as a year ago, and it is quite possible that the opening of navigation in 1914 may see more ore on docks at Lake Erie ports than for some years.

The Year's Changes in Iron and Steel Metallurgy

BY BRADLEY STOUGHTON

There has been a marked increase in the relative importance of electric steel furnaces for casting work, on account of the superior quality of the electric steel for this purpose, as well as the commercial difficulties in the way of producing forging steel super-refined in the electric furnace in competition with ordinary Bessemer and open-hearth steel not refined in this manner. There are now 19 electric furnaces in operation in America, and nearly 150 total in all countries. The commercial manufacture of ferroalloys in the electric furnace continues to increase, but the smelting of iron ore to produce pig iron has not yet justified the early expectations of its advocates. The question of refractories in electric furnace work is a difficult one, and a new refractory which has attracted some attention is said to be a nitride of boron. W. R. Walker has patented his process for recarbonizing the steel in the ladle instead of after it goes to the electric furnace.

PULVERIZED COAL AS A METALLURGICAL FUEL

Besides its use in cement kilns, annealing ovens, heating furnaces, etc., pulverized coal has now been used successfully for more than a year for heating, puddling and open-hearth furnaces, and this type of fuel bids fair to increase greatly in importance in the near future, due to its inherent advantage in the possibility of reaching a very high temperature, as well as its relative economy at the present time as compared with oil, tar, etc.

SOUND INGOTS

One of the most important advances during the years 1912 and 1913 has been in the increased attention given to the importance of manufacturing sound steel ingots, both by a more thorough system of works inspection and by processes for eliminating pipes, etc., with all of which the readers of *The Iron Age* have been made quite familiar in extended publications of papers and discussions.

GASES IN STEEL

Further evidence is adduced to support the belief in the harmful effect of nitrogen on steel and a new method is proposed for the rapid determination of this element. New methods are also proposed for the rapid estimation of oxygen in iron and steel. Charpy and Bonnerot say that hydrogen can be made to diffuse through steel at a red heat without any of it being retained in the metal, and that prolonged diffusion purifies the metal by removing sulphur, phosphorus and carbon as hydrides.

ALLOTROPIC MODIFICATIONS

The work of H. C. H. Carpenter and others has thrown considerable doubt upon the existence of the so-called hard Beta allotropic modification. The latter investigator has also doubted the existence of the A_2 critical point, but this doubt has been shown by Howe and Burgess to be wholly untenable. Howe has devised a new and improved method for determining the A_2 critical point, and Stead has devised a new method for determining the A_1 point.

ALLOY STEELS

The addition of cobalt to steel has proved of great advantage in certain instances, and particularly in the case of high-speed steels. The tentative experiments on copper steels containing from 0.10 to 0.50 per cent. copper indicate at present the superiority of the alloys as regards hardness, durability and resistance to corrosion. The experiments are by no means conclusive. Copper has the effect of lowering the critical point, increasing the elastic limit and the hardness and is said to reduce the amount of sulphur.

CAST IRON

The important researches that have been made upon the qualities of cast iron and the determination of the factors influencing quality are familiar to all readers of *The Iron Age*.

FOUNDRY CUPOLAS

Extended investigations have been made upon the iron cupola melting operation by three German, two Swedish, a French and an American experimenter. These have resulted in showing that the greater part of the heat is lost in the gases which

pass out of the top of the chinmey, and that great economies may be effected by increasing the hight of the cupola, which has to some extent resulted already, although it has not been acted upon intelligently. A second resulting innovation is melting turnings and borings by blowing them in with the blast through the tuyeres. A third suggested change is to incline the tuyeres at an angle of 40 deg. to the horizontal; and a fourth consists in the patented Swedish process for dephosphorizing the iron by oxidation with iron ore at a low temperature.

BLAST FURNACE OPERATIONS

An important improvement in blast furnace gas cleaning is removing the impurities without introducing moisture into the gas. There is a further extension in the use of oxygen for enriching the blast. It has been suggested that blast furnace flue dust might be used as an addition to cement, but experiments indicate a weakening effect.

Foundry Iron Prices at Cincinnati and Chicago

So much interest is being taken in statistics of prices for a long series of years that we have no doubt many of our readers will attach much value to the tables given below, showing average monthly prices of No. 2 Southern foundry pig iron at Cincinnati from 1876 to 1913, inclusive, and No. 2 local foundry pig iron at Chicago from 1888 to 1913, inclusive. These prices are averaged from weekly quotations in the market reports of *The Iron Age* and are per ton of 2240 lb.

Southern No. 2 Foundry Pig Iron at Cincinnati, per Gross Ton

	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888
January	$22.00	$20.00	$18.00	$17.10	$37.75	$22.50	$25.50	$21.62	$17.25	$15.62	$17.00	$20.12	$18.62
February	22.00	20.25	18.00	17.75	41.12	22.50	25.50	21.50	17.00	15.25	17.00	21.00	19.00
March	22.00	20.40	17.62	18.00	38.12	22.50	24.90	20.60	17.75	14.62	17.00	21.00	18.50
April	22.00	20.50	17.75	18.00	33.50	22.50	23.50	20.62	17.87	15.15	17.00	21.00	17.75
May	22.00	20.20	17.00	18.00	26.25	22.25	23.00	20.25	17.25	15.00	16.37	20.50	16.75
June	20.00	20.25	16.25	17.75	23.25	22.00	22.00	19.50	17.25	15.25	16.12	19.40	15.75
July	20.00	19.25	16.00	17.75	22.60	21.50	22.25	19.00	16.62	14.81	15.37	19.50	15.50
August	20.00	18.00	16.20	19.50	24.00	21.50	22.60	18.50	16.00	14.87	15.25	20.00	15.80
September	19.50	18.00	16.75	25.50	24.00	21.75	22.62	18.50	15.87	15.00	16.75	20.00	16.50
October	19.50	18.00	17.00	33.50	23.50	22.00	22.37	18.50	16.25	15.00	17.00	19.75	16.50
November	20.00	18.00	17.00	36.00	22.00	24.50	22.00	18.50	16.18	15.50	17.75	19.50	15.65
December	20.10	18.00	17.00	35.00	22.25	25.00	22.00	18.37	16.25	16.37	18.60	18.87	15.50

	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901
January	$14.75	$18.05	$13.81	$13.75	$12.50	$11.00	$9.25	$11.20	$11.00	$9.50	$10.31	$20.69	$13.45
February	14.37	17.75	13.75	13.62	12.12	10.75	9.25	11.00	9.75	9.25	11.69	20.50	13.12
March	14.50	16.00	14.00	13.10	12.00	10.20	9.25	10.75	9.69	9.25	13.75	20.30	14.00
April	14.25	14.31	13.75	13.00	11.75	9.50	9.25	10.40	9.25	9.25	14.50	20.19	14.50
May	14.00	14.25	14.00	12.81	11.68	9.50	9.50	10.50	8.75	9.37	14.56	19.75	13.85
June	13.68	14.75	13.75	12.81	11.50	9.61	10.12	10.32	8.75	9.30	16.00	18.75	13.37
July	14.12	14.75	13.75	12.40	11.37	9.75	11.50	9.75	8.95	9.25	17.56	16.81	13.00
August	14.50	14.75	13.50	12.17	11.05	9.80	11.50	9.37	9.00	9.37	18.35	14.25	13.00
September	14.50	14.25	13.50	12.00	10.75	10.00	12.75	9.50	9.35	9.55	19.94	13.62	13.06
October	15.31	14.25	13.75	12.25	10.75	10.00	12.75	9.95	9.50	9.75	20.75	12.87	13.75
November	16.62	14.25	14.00	12.50	10.75	9.75	12.75	10.44	9.50	9.75	20.75	12.95	14.00
December	17.56	14.00	13.75	12.50	10.87	9.25	12.50	10.35	9.50	9.90	20.75	13.75	14.25

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
January	$14.55	$21.65	$12.37	$16.25	$16.75	$26.00	$16.15	$16.25	$17.25	$14.25	$13.25	$16.95
February	14.75	21.50	12.12	16.25	16.75	26.00	15.75	16.13	17.06	14.25	13.31	16.68
March	14.75	21.37	12.10	16.25	16.65	26.00	15.50	15.05	16.30	14.25	13.50	16.31
April	16.87	20.15	12.50	16.25	16.63	25.06	15.20	14.25	15.37	14.25	13.75	15.75
May	18.35	18.87	12.25	15.81	16.75	24.25	14.75	14.50	15.00	13.95	14.15	15.00
June	20.19	17.75	11.80	14.65	16.44	24.10	15.25	14.70	14.85	13.44	14.25	14.06
July	20.75	16.15	11.81	13.94	16.06	23.85	15.00	15.75	14.75	13.25	14.70	13.75
August	23.06	15.19	12.00	14.40	17.30	23.00	15.25	16.38	14.31	13.45	15.06	14.06
September	25.00	14.75	12.00	14.37	18.69	21.50	15.65	17.35	14.25	13.31	15.87	14.25
October	25.65	13.50	12.81	15.31	20.00	20.95	15.75	17.88	14.25	13.25	16.80	14.35
November	23.62	12.00	15.19	16.60	23.38	19.50	16.00	17.75	14.25	13.20	17.25	13.87
December	22.44	12.05	15.85	16.75	25.00	17.00	16.25	17.45	14.25	13.19	17.25	14.00

Local No. 2 Foundry Pig Iron at Chicago (at Furnace after 1907), per Gross Ton

	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900
January	$19.00	$16.00	$19.50	$14.60	$14.50	$13.37	$12.50	$9.75	$13.55	$11.02	$11.35	$11.47	$23.85
February	18.87	15.00	18.87	15.00	14.37	12.81	11.87	9.75	12.50	11.00	11.23	12.47	23.85
March	18.12	15.00	17.62	15.00	14.00	13.00	11.30	9.81	12.00	10.88	11.10	14.95	23.85
April	17.50	15.00	16.62	15.12	14.00	13.00	10.50	10.25	12.00	10.75	11.26	15.47	23.72
May	17.00	15.00	16.20	15.00	14.00	12.96	10.50	10.25	11.69	10.38	11.35	15.72	22.65
June	16.25	14.50	16.00	15.00	14.00	13.00	10.50	10.38	11.50	10.25	11.35	17.95	20.72
July	16.00	14.87	16.00	15.15	14.00	12.79	10.12	12.13	11.25	10.25	11.35	19.22	18.60
August	16.00	15.10	16.00	15.00	13.75	12.75	10.00	13.20	11.18	10.25	11.35	20.65	16.25
September	16.50	15.50	16.00	15.00	13.50	12.75	10.00	13.63	10.75	10.40	11.35	22.22	15.35
October	17.12	17.00	16.00	15.00	13.50	12.75	10.00	14.00	10.88	11.00	11.35	23.25	14.85
November	17.00	17.62	15.75	14.94	13.50	12.75	9.70	14.00	11.19	11.00	11.35	23.45	14.85
December	16.87	18.66	15.37	14.62	13.50	11.69	9.75	14.00	11.25	11.00	11.35	23.85	15.10

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
January	$15.10	$16.25	$23.45	$14.47	$17.85	$19.60	$25.85	$18.45	$17.35	$19.00	$15.50	$14.00	$17.90
February	14.60	16.85	23.35	13.91	17.85	19.41	25.85	18.16	16.75	19.00	15.50	14.00	17.31
March	15.60	18.51	23.22	14.05	17.80	19.35	26.10	17.85	16.50	18.20	15.50	14.00	17.25
April	15.85	18.97	22.87	14.35	17.60	19.10	26.35	17.73	16.50	17.50	15.00	14.00	17.06
May	15.85	20.85	20.72	13.85	17.60	18.90	26.85	17.63	16.50	17.06	15.00	14.50	16.15
June	15.35	21.85	19.85	13.70	17.00	18.54	26.60	17.73	16.50	16.75	15.00	14.50	15.63
July	15.35	21.60	18.25	13.60	16.47	18.60	25.55	17.55	17.00	16.56	14.87	14.70	14.70
August	15.35	22.10	17.22	13.60	16.60	19.45	24.85	17.35	17.13	16.50	14.50	15.37	15.00
September	15.35	22.35	16.41	13.85	16.60	20.16	24.10	17.05	18.70	16.40	14.50	16.00	15.00
October	15.10	23.35	15.70	14.10	17.66	21.48	22.45	16.85	19.00	16.06	14.46	17.00	15.00
November	15.23	23.35	15.10	15.98	19.15	24.70	20.66	17.10	19.00	16.00	14.09	17.75	14.88
December	15.85	23.35	14.81	16.95	19.60	25.85	18.80	17.35	19.00	16.00	14.00	18.00	14.50

The Cincinnati prices given above date back to the earliest period for which Southern pig-iron quotations are available at that point. It may be said that these quotations represent almost the beginning of the Northern business in pig iron coming from the vicinity of Birmingham, Ala.

The Chicago prices also represent quotations from the beginning of the production of pig iron in the vicinity of Chicago for the merchant trade. For a long time these prices were quoted delivered on track near Chicago foundries, but beginning in 1908 prices were figured at the furnace, from which at that time a switching charge to local foundries of about 35 cents per ton applied. At the present time the switching charge averages about 50 cents.

Metal, Tin-Plate and Sheet Prices for Sixteen Years

Monthly Averages Computed from the Weekly Market Quotations of "The Iron Age" in the Period of 1898-1913

(With Supplement)

The accompanying supplement shows by plotted lines the fluctuations in prices of the more important metals, tin plates and sheets in the period from 1898 to 1913, inclusive. The prices used for this purpose are the computed monthly averages of the prices of carloads, at New York, for metals and at Pittsburgh for tin plate and No. 28 black steel sheets, given in the metal market reports of *The Iron Age* week by week. The columns of figures alongside the chart give the values. The column nearest the chart gives tin in cents per pound; the middle column, copper in cents per pound, and the outside column represents lead, spelter and steel sheets in cents per pound and tin plate in dollars per base box. The following tables give the monthly averages on which the chart is based:

Lake Copper, at New York, in Cents per Pound

	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
January	11.00	14.02	16.21	16.90	11.45	12.13	12.62	15.18	18.78	24.41	13.90	14.56	14.00	12.81	14.50	16.98
February	11.19	17.66	16.25	16.97	12.47	12.80	12 34	15.25	17.94	25.10	13.13	13.37	13.78	12.75	14.41	15.55
March	11.95	17.55	16.41	17.00	12.12	14.31	12.60	15.25	18.50	23.38	12.85	12.90	13.75	12.58	14.88	15.05
April	12.05	18.56	17.00	17.00	11.97	14.85	13.19	15.18	18.62	24.62	13.09	12.94	13.31	12.41	16.00	15.67
May	12.04	18.65	16.80	17.00	12.10	14.75	13.28	15.00	18.70	24.10	12.88	13.21	13.06	12.33	16.30	15.91
June	11.85	18.20	16.31	17.00	12.23	14.56	12.74	15.00	18.69	23.94	13.00	13.50	12.88	12.71	17.53	15.42
July	11.59	18.37	16.31	16.97	11.94	13.73	12.62	15.03	18.47	21.95	13.00	13.34	12.66	12.78	17.54	14.78
August	11.85	18.50	16.55	16.50	11.59	13.35	12.50	16.07	18.65	18.94	13.71	13.56	12.93	12.75	17.73	15.86
September	13.25	18.47	16.75	16.50	11.60	13.58	12.67	16.12	19.31	16.41	13.80	13.50	12.81	12.65	17.77	16.77
October	12.37	18.03	16.73	16.71	11.71	13.42	13.09	16.62	21.81	13.80	13.81	13.19	12.84	12.53	17.80	16.85
November	12.69	17.00	16.75	16.82	11.44	13.25	14 22	16.90	22.50	13.94	14.44	13.44	12.98	12.80	17.70	16.16
December	12.79	16.69	16.87	14.71	11.61	12.30	14.87	18.75	23.06	13.48	14.53	13.80	13.00	13.84	17.69	14.93

Spelter, at New York, in Cents per Pound

January	3.75	4.90	4.55	4.08	4.28	4.82	4.95	6.17	6.48	6.90	4.54	5.15	6.26	5.55	6.52	7.15
February	3.79	5.68	4.69	3.94	4.18	5.00	4 95	6.12	6.09	7.00	4.78	4.99	5.89	5.56	6.71	6.45
March	4.00	5.99	4.60	3.89	4.29	5.36	5.05	6.06	5.96	6.92	4.76	4.81	5.72	5.65	6.98	6.26
April	4.00	6.25	4.71	3.94	4.41	5.65	5.22	5.97	6.05	6.81	4.68	4.94	5.60	5.51	6.86	5.77
May	3.95	6.72	4.52	3.97	4.50	5.75	5.14	5.55	5.95	6.51	4.60	5.12	5.20	5.50	6.86	5.47
June	4.65	6.02	4.27	3.95	4.88	6.00	4.79	5.32	6.14	6.45	4.56	5.39	5.19	5.63	6.99	5.18
July	4.51	5.79	4.24	3.90	5.23	5.95	4.85	5.38	5.98	6.15	4.46	5.35	5.20	5.79	7.26	5.38
August	4.35	5.55	4.17	3.92	5.46	5.94	4.85	5.66	6.06	5.71	4.71	5.74	5.26	6.04	7.19	5.75
September	4.62	5.40	4.10	4.02	5.45	6.00	5.06	5.83	6.19	5.28	4.76	5.85	5.53	6.03	7.53	5.82
October	4.61	5.37	4.10	4.20	5.48	6.05	5.17	6.05	6.18	5.45	4.81	6.09	5.69	6.20	7.57	5.42
November	5.09	4.64	4.20	4.32	5.29	5.68	5.49	6.17	6.36	5.10	5.03	6.32	5.95	6.60	7.48	5.29
December	5.13	4.68	4.19	4.35	4.91	5.15	5.80	6.50	6.62	4.39	5.17	6.35	5.80	6.44	7.33	5.15

Lead, at New York, in Cents per Pound

January	3.66	4.02	4.70	4.37	4.02	4.10	4.39	4.56	5.86	6.30	3.73	4.19	4.70	4.50	4.41	4.35
February	3.69	4.53	4.70	4.37	4.10	4.10	4.40	4.50	5.56	6.31	3.75	4.07	4.63	4.46	4.00	4.35
March	3.71	4.37	4.70	4.37	4.10	4.44	4.50	4.45	5.35	6.31	3.88	4.02	4.51	4.41	4.08	4.35
April	3.61	4.30	4.70	4.37	4.10	4.59	4.50	4.50	5.39	6.16	4.02	4.19	4.40	4.44	4.20	4.40
May	3.64	4.42	4.22	4.37	4.10	4.37	4.48	4.50	5.90	6.02	4.26	4.32	4.37	4.40	4.20	4.37
June	3.86	4.45	3.90	4.37	4.10	4.25	4.22	4.51	5.94	5.75	4.45	4.36	4.38	4.46	4.50	4.35
July	3.95	4.55	4.03	4.37	4.10	4.12	4.17	4.56	5.80	5.24	4.50	4.35	4.40	4.50	4.67	4.37
August	3.99	4.56	4.26	4.37	4.10	4.12	4.15	4.64	5.78	5.12	4.59	4.36	4.40	4.50	4.54	4.64
September	3.99	4.60	4.36	4.37	4.10	4.26	4.20	4.85	5.92	4.84	4.54	4.39	4.40	4.49	5.04	4.73
October	3.81	4.59	4.37	4.37	4.10	4.40	4.20	5.07	5.94	4.64	4.34	4.39	4.40	4.31	5.06	4.52
November	3.70	4.58	4.37	4.37	4.10	4.25	4.51	5.48	5.97	4.45	4.39	4.40	4.44	4.31	4.66	4.33
December	3.62	4.65	4.37	4.19	4.10	4.19	4.60	5.96	6.19	3.76	4.24	4.56	4.50	4.45	4.32	4.05

Tin, at New York, in Cents per Pound

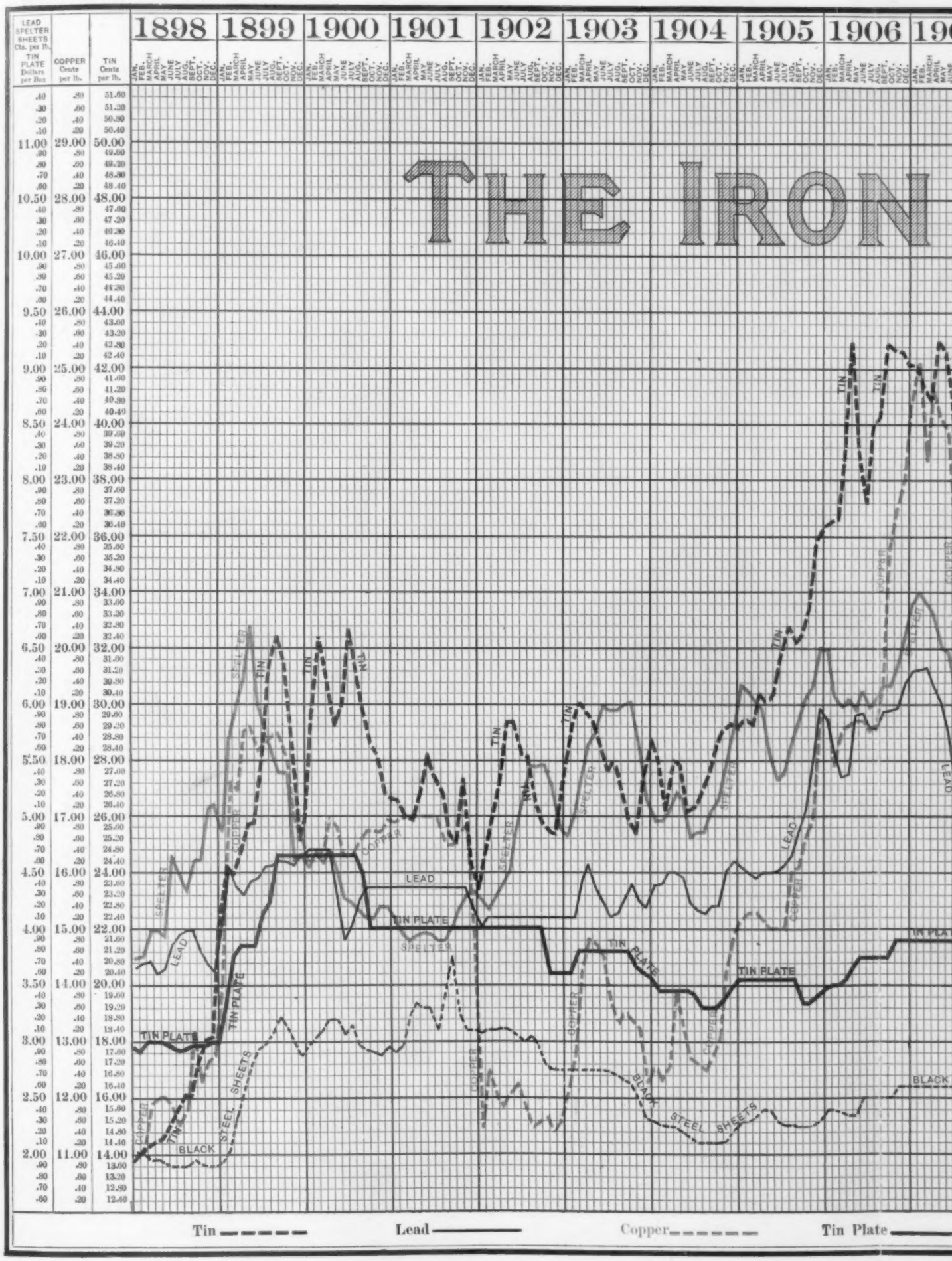
January	13.77	22.12	26.00	26.60	23.38	27.76	28.75	29.18	36.36	42.14	27.43	28.19	32.61	41.20	44.58	50.34
February	14.04	24.25	29.71	26.55	24.73	29.14	27.98	29.49	36.48	42.16	28.74	28.44	32.65	43.34	43.56	48.71
March	14.26	23.86	32.42	25.95	26.16	30.06	26.19	29.21	36.62	41.29	30.46	28.75	32.51	41.10	42.76	46.93
April	14.41	24.82	30.85	25.94	27.29	29.69	27.99	30.43	38.86	40.84	31.79	29.35	32.83	42.05	43.64	49.04
May	14.54	25.61	29.25	26.82	29.26	29.36	27.76	30.04	43.08	43.01	29.84	29.07	33.05	43.32	45.98	49.06
June	15.05	25.69	30.00	28.22	29.29	28.30	26.14	30.36	38.97	42.65	28.18	29.26	32.79	46.25	47.44	45.01
July	15.60	28.72	32.76	27.41	28.28	27.60	26.28	31.71	37.18	41.15	28.92	29.05	32.99	43.23	44.70	41.32
August	16.14	31.40	31.13	26.90	28.14	28.00	26.74	32.85	39.90	37.35	29.99	29.96	33.92	43.38	45.86	41.63
September	16.02	32.40	29.63	25.04	26.55	27.06	27.27	32.21	40.32	37.22	28.91	30.00	35.17	39.69	49.16	42.63
October	17.25	31.35	28.46	24.62	25.76	25.83	28.53	32.47	42.90	32.33	29.44	30.41	36.76	41.23	50.07	40.38
November	18.07	28.52	28.10	27.47	25.43	25.35	29.00	33.46	42.70	30.81	30.43	30.74	37.38	43.08	49.87	39.75
December	18.20	25.19	26.84	24.39	25.33	27.53	29.27	35.84	42.62	27.92	29.13	32.91	38.21	45.03	49.86	37.17

Tin Plate, at Pittsburgh, in Dollars per Box

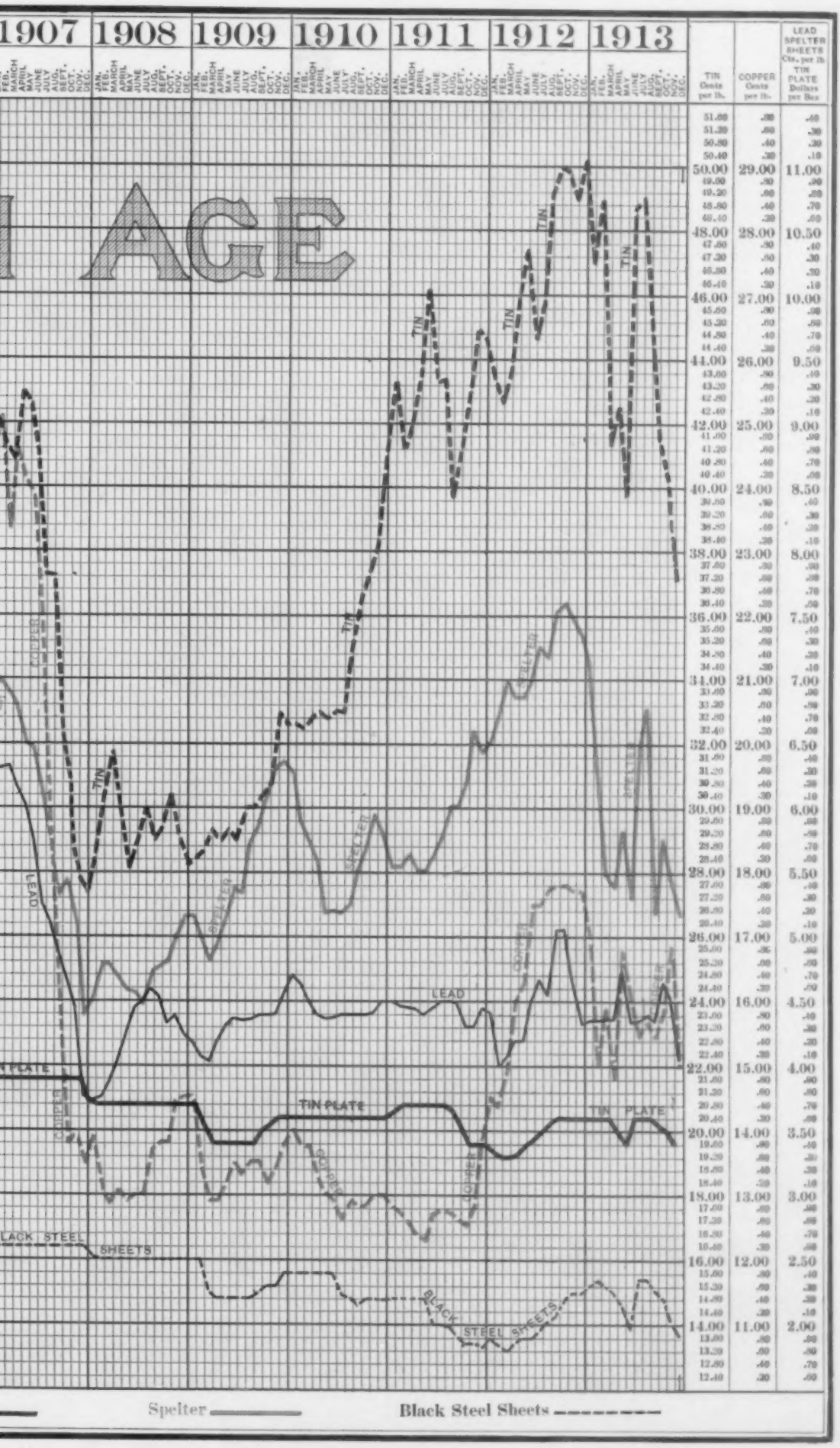
January	$2.95	$3.00	$4.65	$4.00	$4.00	$3.60	$3.56	$3.55	$3.47	$3.90	$3.74	$3.70	$3.60	$3.60	$3.40	$3.60
February	2.90	3.38	4.65	4.00	4.00	3.60	3.45	3.55	3.50	3.90	3.70	3.70	3.60	3.67	3.35	3.60
March	3.00	3.75	4.65	4.00	4.00	3.80	3.45	3.55	3.50	3.90	3.70	3.53	3.60	3.70	3.30	3.60
April	3.00	3.87	4.65	4.00	4.00	3.80	3.45	3.55	3.57	3.90	3.70	3.40	3.60	3.70	3.30	3.60
May	3.00	3.87	4.65	4.00	4.00	3.80	3.45	3.55	3.66	3.90	3.70	3.40	3.60	3.70	3.33	3.60
June	2.99	3.87	4.65	4.00	4.00	3.80	3.45	3.55	3.75	3.90	3.70	3.40	3.60	3.70	3.40	3.60
July	2.94	4.12	4.65	4.00	4.00	3.80	3.41	3.55	3.75	3.90	3.70	3.40	3.60	3.70	3.43	3.60
August	2.93	4.23	4.65	4.00	4.00	3.80	3.30	3.55	3.75	3.90	3.70	3.40	3.60	3.70	3.50	3.55
September	2.98	4.65	4.50	4.00	4.00	3.80	3.30	3.55	3.75	3.90	3.70	3.40	3.60	3.67	3.58	3.50
October	2.98	4.65	4.00	4.00	4.00	3.80	3.30	3.34	3.75	3.90	3.70	3.50	3.60	3.52	3.60	3.50
November	2.98	4.65	4.00	4.00	3.60	3.65	3.39	3.34	3.90	3.90	3.70	3.56	3.60	3.40	3.60	3.40
December	3.00	4.65	4.00	4.00	3.60	3.60	3.47	3.40	3.90	3.90	3.70	3.60	3.60	3.40	3.60	3.40

No. 28 Black Steel Sheets, at Pittsburgh, in Cents per Pound

January	2.02½	1.92½	2.97½	2.90	3.07½	2.75	2.29	2.30	2.40	2.60	2.52	2.50	2.40	2.20	1.90	2.31
February	2.00	2.05	3.03	2.93¾	3.10	2.75	2.27½	2.30	2.40	2.60	2.50	2.50	2.40	2.20	1.87	2.35
March	1.96	2.36	3.10	3.22½	3.10	2.75	2.27	2.34	2.38	2.60	2.50	2.25	2.40	2.20	1.80	2.35
April	1.97½	2.60	3.20	3.35	3.12½	2.75	2.25	2.40	2.35	2.60	2.50	2.20	2.40	2.20	1.86	2.35
May	1.92½	2.78¾	3.20	3.30	3.10	2.75	2.20	2.40	2.35	2.60	2.50	2.20	2.40	2.20	1.90	2.30
June	1.90	2.93	3.05	3.30	3.05	2.75	2.16	2.30	2.50	2.60	2.50	2.20	2.40	2.00	1.90	2.27
July	1.90	2.97½	3.14¾	3.10	3.00	2.73¾	2.10	2.26	2.50	2.60	2.50	2.20	2.23¾	2.00	1.95	2.25
August	1.90	3.08	2.98	3.41	3.05	2.70	2.10	2.26	2.50	2.60	2.50	2.20	2.21	1.99	2.02	2.21
September	1.96	3.22½	2.93¾	3.77½	2.97½	2.65	2.10	2.25	2.50	2.60	2.50	2.26	2.15	1.91	2.07	2.14
October	1.92	3.15	2.90	3.23	2.79	2.62	2.10	2.25	2.50	2.60	2.50	2.30	2.20	1.85	2.21	2.04
November	1.90	3.00	2.89	3.10	2.75	2.49	2.12½	2.27	2.60	2.60	2.50	2.30	2.20	1.85	2.25	1.97
December	1.90	2.87½	2.96	3.10	2.75	2.32	2.22	2.30	2.60	2.60	2.50	2.40	2.19	1.83¾	2.25	1.90



Fluctuations in Carload Prices of Lake Copper, Lead, Tin a
No. 28 Black Steel Sheets in Pittsburgh from Ja



TIN Cents per lb.	COPPER Cents per lb.	LEAD SPELTER SHEETS Cts., per lb. TIN PLATE Dollars per Box
51.60	.30	.40
51.30	.60	.30
50.80	.40	.20
50.40	.30	.10
50.00	29.00	11.00
49.60	.30	.90
49.20	.60	.80
48.80	.40	.70
48.40	.30	.60
48.00	28.00	10.50
47.60	.30	.40
47.20	.60	.30
46.80	.40	.20
46.40	.30	.10
46.00	27.00	10.00
45.60	.30	.90
45.20	.60	.80
44.80	.40	.70
44.40	.30	.60
44.00	26.00	9.50
43.60	.30	.40
43.20	.60	.30
42.80	.40	.20
42.40	.30	.10
42.00	25.00	9.00
41.60	.30	.90
41.20	.60	.80
40.80	.40	.70
40.40	.30	.60
40.00	24.00	8.50
39.60	.30	.40
39.20	.60	.30
38.80	.40	.20
38.40	.30	.10
38.00	23.00	8.00
37.60	.30	.90
37.20	.60	.80
36.80	.40	.70
36.40	.30	.60
36.00	22.00	7.50
35.60	.30	.40
35.20	.60	.30
34.80	.40	.20
34.40	.30	.10
34.00	21.00	7.00
33.60	.30	.90
33.20	.60	.80
32.80	.40	.70
32.40	.30	.60
32.00	20.00	6.50
31.60	.30	.40
31.20	.60	.30
30.80	.40	.20
30.40	.30	.10
30.00	19.00	6.00
29.60	.30	.90
29.20	.60	.80
28.80	.40	.70
28.40	.30	.60
28.00	18.00	5.50
27.60	.30	.40
27.20	.60	.30
26.80	.40	.20
26.40	.30	.10
26.00	17.00	5.00
25.60	.30	.90
25.20	.60	.80
24.80	.40	.70
24.40	.30	.60
24.00	16.00	4.50
23.60	.30	.40
23.20	.60	.30
22.80	.40	.20
22.40	.30	.10
22.00	15.00	4.00
21.60	.30	.90
21.20	.60	.80
20.80	.40	.70
20.40	.30	.60
20.00	14.00	3.50
19.60	.30	.40
19.20	.60	.30
18.80	.40	.20
18.40	.30	.10
18.00	13.00	3.00
17.60	.30	.90
17.20	.60	.80
16.80	.40	.70
16.40	.30	.60
16.00	12.00	2.50
15.60	.30	.40
15.20	.60	.30
14.80	.40	.20
14.40	.30	.10
14.00	11.00	2.00
13.60	.30	.90
13.20	.60	.80
12.80	.40	.70
12.40	.30	.60

and Spelter in New York and Tin Plate and January 1, 1898, to January 1, 1914

The Sheet and Tin-Plate Trades in 1913

BY B. E. V. LUTY

From a tonnage standpoint the sheet and tin-plate mills had a good year in 1913. From the viewpoint of profits the showing was not so favorable.

In 1912 the production of sheets (excluding black plates) of No. 13 gauge and lighter was 1,857,683 gross tons, and although this exceeded the previous record, made in 1910, by 29 per cent., it is probable that the 1913 production was still larger. The same statement may be made as to tin plate. The 1912 production of black plate was 982,197 gross tons, and of tin plate 962,971 gross tons, these tonnages being 23 per cent. in excess of the previous record, which was made in 1911. In passing it may be remarked that the peculiar disposition of tin plate, to do well in "off" years, was well illustrated in this instance, as sheet production was less in 1911 than in 1910, whereas tin plate production was the greater in 1911. It is probable that the production of black plates and tin plates in 1913 exceeded the output in 1912.

OUTPUT PER MILL

A large part of the great increase in output in recent years in both sheets and tin plates has been due to greater outputs per mill, although there have in some years been considerable additions to the number of mills. The increased output per mill has been achieved by a combination of influences. At most plants there is a much more efficient sorting of orders than there used to be, whereby it is relatively seldom that the size or gauge is changed during a turn. Mills are constantly being made heavier, in the aggregate, through new and heavy mills being added, or replacing old and lighter mills, and more power is being given. The practice of employing helpers has become general. Heating furnaces are being improved.

It is not uncommon for tin mills, running on the average gauge, which is nearer No. 31 than No. 30, to average four to five gross tons per turn, or about 72 gross tons a week, which, at 50 weeks' operation in the year, is an average of 3600 gross tons per year per mill. While not many plants show as good an average as this, there are some which do so, and there are many which come close to the mark, so that the average of all mills is above 3000 gross tons a year, given fairly continuous operation. It is impossible to make a corresponding general statement for the tonnage output of sheet mills by reason of the fact that gauges vary so greatly, while some mills run more to light gauges and some mills more to heavy gauges. The average gauge of all galvanized sheets produced, having reference to tonnage, is a trifle heavier than No. 26. In uncoated sheets the average gauge is heavier, if blue annealed be included.

The most important additions to capacity during the year were the two new plants built respectively by the Trumbull Steel Company at Warren, Ohio, and the Wheeling Sheet & Tin Plate Company at Yorkville, Ohio, each being designed as a 12-mill plant. The Warren plant is equipped to make regular sheets, both black and galvanized, while the Yorktown plant is equipped to make tin plate and tin mill sizes of sheets. At several existing plants additional mills were completed in 1913, but on the whole new erection in both sheets and tin plates was light as compared with the great expansion which occurred in some previous years.

PRICES AND PROFITS

The average openly quoted prices in 1913, Pittsburgh basis, were as follows:

	No. 28 black sheets. Cents per lb.	No. 28 galvanized sheets. Cents per lb.	Tin plates, per base for 100-lb.
January	2.32	3.47	$3.60
February	2.35	3.50	3.60
March	2.35	3.50	3.60
April	2.35	3.45	3.60
May	2.35	3.40	3.60
June	2.29	3.38	3.60
July	2.25	3.31	3.60
August	2.20	3.25	3.60
September	2.12	3.17	3.60
October	2.04	3.08	3.50
November	1.98	2.98	3.40
December	1.90	2.90	3.40
Year 1913	2.21	3.28	$3.56
Year 1912	2.00	3.07	3.46

In the last analysis, the outstanding feature in the great question of prices and profits in the sheet and tin-plate industries is that while on the one hand the mills buy their raw materials from those who have no great interest in retaining their customers, on the other hand their sales policy is dictated by a desire to retain their customers. Thus their buying and selling markets are different. The sellers of pig tin and of spelter are supremely indifferent to the matter of retaining customers. Day by day they sell on a purely price competitive basis, striving to get as high a price as they can from any buyer whose credit is satisfactory. The sellers of sheet bars are not so absolutely indifferent as are the sellers of the coating metals, but on the whole the tonnages of sheet bars they sell are dictated chiefly by the condition in their own finishing departments; the fundamental idea is that of disposing of a surplus steel product, and of getting as much for the tonnage as possible. As a rule, a customer is allowed to go elsewhere if he can there secure a lower price. Exceptions are made to this policy, but usually only when the market is dull and prices are low.

The attitude of the seller of sheets or tin plates is entirely different. He has his trade and is very jealous of it. If his customer is named a lower price elsewhere he promptly meets that price, and very often in his jealousy he meets an imaginary price on the unsupported representation of his customer.

Thus the position of the sheet and tin mills is that when they sell they sell in a strongly competitive market, whereas when they buy they cannot arouse a similar competition among those from whom they buy. They cut prices to retain their own customers, but they cannot induce those from whom they purchase to make similar cuts, in order to retain them as customers. A factor which tends to accentuate this condition is that there are many sellers of sheets and tin plates and only a few sellers of sheet bars.

The sheet and tin-plate mills which have steel producing mills of their own are not, of course, among those whose position has been referred to above, but the integrated mills do not on that account tend to lessen the competition. They are disposed to be jealous of the fact that they are self-contained as to steel, and to feel that if a detached finishing mill can name a certain price they, with their own steel mill, can go enough farther to take the business.

It is well known that there is a strongly competitive market in sheets and tin plates at all times. Sometimes statements are made in such form as to

suggest a belief that it is due to the temperament of the men who are engaged in this business that the market is so strongly competitive and that prices frequently do not afford any margin of profit. The above presentation is made as an argument that it lies in the peculiar conditions surrounding these industries, rather than in temperamental difference on the part of those engaged in them, that the competition is so keen and so frequently injurious.

The quoted prices in 1913 do not tell the tale of actually realized prices. During the first half of the year the mills were engaged in filling contracts taken at much below the then ruling market. The last advances on the upward movement were $2 a ton about the middle of October, 1912, and $2 a ton about the middle of January, 1913, these advances making a change in black sheets from 2.15c. to 2.35c. and in galvanized sheets from 3.30c. to 3.50c., Pittsburgh. Some of the lower contracts were worked out well before the middle of 1913, but it was not until the middle of the year that the midway contracts expired, and even then they left a considerable tonnage on mill books in the way of specifications. Thus the openly quoted sheet market declined approximately at the time when the mills really stood to realize the prices. The final advances had been practically paper advances.

Early in 1913 sheet bars were hard to get at $30, though most of the mills had contracts for limited tonnages at somewhat lower figures, and the average margin between the cost of steel and the realized prices on sheets shipped was but little better than when the whole market had been at bottom, a year earlier, with sheet bars at about $20 and sheets at about 1.80c. At the close of 1913 sheet bars were down to $21 but sheets were unsteady at 1.90c., and the whole price movement had been of little advantage to the mills.

The position of the tin-plate mills in the fore part of 1913 was fully as difficult as that of the sheet mills, because the tin-plate mills had to contend also with an advance in pig tin. The market price for the 1913 tin-plate season was established early in September, 1912, when pig tin was 47¼c., while in January the average was 50½c. This may seem a trifling matter, but computation shows that a change of 2c. per lb. in the cost of pig tin is equivalent to fully 1 per cent. a year on a normal capitalization of a tin-plate plant.

The tin-plate mills were still more unfortunate in the matter of sheet bars, since that market advanced sharply after the bulk of the tin plate had been sold for the season of 1913. For the season of 1914 the tin mills may fare better, for the fixing of the season price, $3.40 Pittsburgh, November 3, was followed by slight declines in the raw materials, rather than the sharp advances which had occurred a year earlier. It is impossible, however, for the tin mills to cover entirely for their raw materials at the time they sell their product.

Billet Prices for Twenty-Eight Years

The table below gives the average monthly prices of 4 x 4 in. Bessemer steel billets at Pittsburgh from 1886 to 1913, inclusive. The prices are per gross ton and are averaged from weekly quotations in *The Iron Age*. Prior to 1886 steel billets were not a regular merchant commodity, seldom being mentioned in market reports.

	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899
January	$33.00	24.50	29.38	28.15	36.65	25.60	25.00	21.56	16.12	14.90	16.80	15.42	14.93	16.62
February	33.13	35.44	29.38	27.81	35.25	26.00	24.36	21.62	15.75	14.95	17.38	15.25	15.06	18.00
March	33.00	36.00	29.13	27.25	31.88	26.25	23.00	22.60	15.55	14.84	17.09	15.44	15.25	24.30
April	32.00	34.75	28.63	27.00	28.38	25.35	22.81	22.44	15.69	15.44	19.53	14.60	15.06	25.37
May	30.50	32.38	28.35	26.90	27.55	25.50	22.41	21.69	18.00	16.30	19.50	13.82	14.85	26.75
June	30.75	31.40	28.06	26.75	30.25	25.25	22.97	21.70	18.12	18.63	19.12	14.06	14.65	30.10
July	30.33	31.50	28.00	27.13	30.70	25.50	23.50	21.06	18.00	20.75	18.85	14.00	14.50	33.12
August	30.00	32.50	28.40	28.20	30.38	25.31	23.81	20.45	17.15	21.75	18.75	14.00	15.85	35.40
September	30.50	31.80	29.00	29.50	30.13	25.00	23.65	19.31	17.19	24.00	19.75	15.60	16.00	38.37
October	31.63	31.63	29.25	33.70	28.70	24.90	23.53	18.06	16.00	21.90	19.75	16.44	15.56	38.75
November	32.00	31.00	29.00	34.00	27.39	24.16	24.94	17.37	15.57	19.13	20.00	15.57	15.06	36.50
December	32.90	29.00	28.44	35.60	26.25	24.20	22.40	16.69	15.12	16.97	17.50	15.00	15.80	33.75

	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
January	34.50	19.75	27.50	29.60	23.00	22.75	26.25	29.40	28.00	25.00	27.50	23.00	20.00	28.30
February	34.87	20.31	29.37	29.87	23.00	23.50	26.50	29.50	28.00	25.00	27.50	23.00	20.00	28.50
March	33.00	22.88	31.25	30.62	23.00	24.00	26.70	29.00	28.00	23.00	27.50	23.00	19.75	28.50
April	32.00	24.00	31.50	30.25	23.00	24.00	27.00	30.12	28.00	23.00	26.75	23.00	20.00	28.50
May	28.90	24.00	32.20	30.37	23.00	23.50	26.40	30.30	28.00	23.00	26.12	22.60	20.80	27.60
June	27.25	24.38	32.37	28.87	23.00	22.00	26.63	29.62	25.75	23.00	25.30	21.00	20.87	26.50
July	21.00	24.00	31.75	27.60	23.00	22.00	27.25	30.00	25.00	23.50	25.00	21.00	21.50	26.60
August	18.20	24.20	31.06	27.00	23.00	24.00	27.80	29.25	25.00	24.13	24.62	21.00	22.12	26.00
September	16.93	24.88	29.50	27.00	20.00	25.00	28.00	29.37	25.00	25.00	24.40	20.75	23.62	24.87
October	16.50	26.70	29.70	27.00	19.50	25.62	28.00	28.20	25.00	26.25	23.75	20.00	26.00	23.30
November	18.95	27.00	28.50	24.00	20.25	26.00	28.88	28.00	25.00	27.13	23.30	19.50	27.00	21.00
December	19.75	27.50	29.12	23.00	21.20	26.00	29.50	28.00	25.00	27.50	23.00	19.25	27.00	20.00

Wire Rod Prices for Thirteen Years

It would be extremely desirable to give wire rod prices for at least 20 years, but it is found that quotations did not regularly appear in market reports until 1901. The table given below therefore represents the available figures as far as public prices are concerned. They are for Bessemer wire rods, per gross ton, at Pittsburgh, and are averaged from weekly quotations in *The Iron Age*.

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
January	....	$33.45	$34.70	$30.00	$31.00	$33.75	$37.00	$34.30	$33.00	$33.00	$28.00	$24.37½	$30.00
February	....	35.00	35.75	30.00	31.00	34.00	37.00	35.00	33.00	33.00	28.75	25.00	30.00
March	....	35.50	36.62½	30.80	31.70	34.00	37.00	35.00	33.00	33.00	29.00	25.00	30.00
April	....	36.00	37.00	31.00	34.00	34.12½	37.00	35.00	29.00	32.50	29.00	25.00	30.00
May	....	36.80	37.00	30.50	34.00	34.40	37.00	35.00	27.50	32.00	29.00	25.00	30.00
June	....	37.00	36.62½	29.20	33.30	34.00	37.12½	33.50	27.50	30.80	28.25	25.00	29.50
July	....	36.00	35.80	28.00	31.87½	34.00	36.50	33.00	29.40	29.25	27.00	25.00	28.30
August	....	36.00	35.00	28.00	32.10	34.00	36.10	33.25	31.00	28.25	27.00	25.80	28.00
September	....	35.87½	34.75	27.00	31.12½	34.00	36.00	33.00	31.50	28.00	27.00	27.00	27.37½
October	$32.75	35.90	34.00	26.00	31.75	34.50	35.40	33.00	31.87½	28.50	26.00	28.50	26.60
November	33.00	35.50	31.62½	26.75	32.10	35.50	34.00	33.00	32.50	28.12½	25.30	29.75	25.87½
December	32.62½	34.50	30.50	29.80	32.50	37.00	34.00	33.00	33.00	28.00	24.50	30.00	25.17

Cast-Iron Pipe Prices—1900 to 1913

The accompanying diagram shows the course of prices for the past 14 years on 6-in. cast-iron water pipe, f.o.b. New York City, in carload lots, per ton of 2000 lb. The pipe prices for the first 10 years were furnished by Daniel Runkle, of the Warren Foundry & Machine Company, 111 Broadway, New York, and for the remainder of the period covered were averaged from weekly quotations in *The Iron Age*. For those who desire the data on which the pipe curve is constructed, the following average monthly prices are presented:

Cast-Iron Pipe Prices at New York, 6-Inch, Per Net Ton

	1900	1901	1902	1903	1904	1905	1906
January	$27.50	$21.75	$24.50	$29.25	$24.50	$28.00	$29.75
February	26.75	22.25	25.00	29.25	24.25	28.50	29.50
March	26.75	21.50	26.25	30.75	24.25	26.75	30.50
April	26.50	22.00	26.00	31.00	24.25	27.00	29.75
May	26.00	22.25	27.75	30.75	24.00	27.25	31.00
June	24.50	23.00	28.00	30.75	23.50	27.25	32.50
July	24.75	23.75	28.50	30.75	23.50	27.25	30.25
August	23.50	23.75	29.50	29.50	23.50	27.75	30.50
September	22.25	23.50	29.50	29.00	23.00	27.25	31.00
October	21.75	24.00	29.50	26.00	23.25	28.25	33.00
November	21.75	24.50	30.75	24.50	25.00	29.00	33.25
December	21.75	23.75	29.25	24.25	27.00	29.25	35.50

	1907	1908	1909	1910	1911	1912	1913
January	$34.25	$27.00	$24.50	$25.50	$22.00	$22.00	$25.00
February	34.25	26.75	24.25	25.50	21.50	22.00	24.75
March	34.00	26.25	25.25	25.50	21.00	22.00	23.87
April	33.50	26.25	25.00	25.50	21.00	21.25	23.50
May	34.25	26.25	25.25	25.50	21.00	21.00	23.00
June	33.50	25.75	26.00	25.25	21.00	21.00	23.00
July	34.00	25.75	26.25	24.00	21.00	22.10	23.00
August	32.50	25.25	26.00	23.50	21.00	22.00	23.00
September	33.00	25.75	25.75	23.50	21.00	23.12	23.00
October	33.50	25.75	25.50	23.00	21.00	24.50	23.00
November	28.50	25.00	25.87	22.12	21.40	24.12	23.00
December	28.00	25.50	25.70	22.00	22.00	24.62	22.33

To show how closely cast-iron pipe prices follow the fluctuations in pig iron, we have added to the pipe curve another giving the course of prices on gray forge pig iron at Philadelphia and vicinity, as gray forge is largely used in making pipe. The prices on which this curve is constructed have been averaged from weekly prices in *The Iron Age* and are as follows:

Gray Forge Pig-Iron, Philadelphia and Vicinity, Gross Ton

	1900	1901	1902	1903	1904	1905	1906
January	$20.37	$14.50	$15.75	$21.75	$13.50	$16.25	$16.75
February	20.25	14.50	15.75	21.25	13.50	15.75	17.00
March	19.25	14.00	17.50	20.00	12.75	16.25	16.75
April	18.75	14.37	18.25	20.00	13.75	16.25	16.75
May	18.00	14.37	19.00	19.50	13.75	16.00	16.50
June	16.50	14.37	19.25	18.25	13.50	15.75	16.25
July	14.50	14.12	21.75	18.12	13.25	14.50	16.10
August	14.50	14.00	21.00	15.50	12.50	15.00	16.50
September	14.00	14.00	21.00	14.75	13.00	15.00	17.75
October	13.50	14.12	21.00	14.50	12.75	15.75	18.25
November	14.00	14.37	22.00	14.00	14.00	16.25	20.00
December	14.50	14.87	22.25	14.00	15.50	16.50	22.00

	1907	1908	1909	1910	1911	1912	1913
January	$23.50	$16.50	$16.25	$17.75	$14.25	$14.25	$17.65
February	23.50	16.50	16.25	17.50	14.25	14.25	17.31
March	23.50	16.50	15.50	16.90	14.60	14.25	16.87
April	23.00	16.00	15.00	16.62	14.75	14.37	16.56
May	23.25	16.00	15.00	16.00	14.70	14.50	15.81
June	23.00	15.25	15.25	15.65	14.50	14.62	15.37
July	22.50	15.25	15.50	15.37	14.50	14.87	14.95
August	20.25	15.25	16.25	15.00	14.30	15.37	14.62
September	19.50	15.50	17.00	14.75	14.45	15.87	14.56
October	18.75	15.50	17.50	14.50	14.25	16.87	15.00
November	17.00	15.75	18.00	14.37	14.25	17.62	14.75
December	16.75	16.00	18.00	14.25	14.25	17.75	14.58

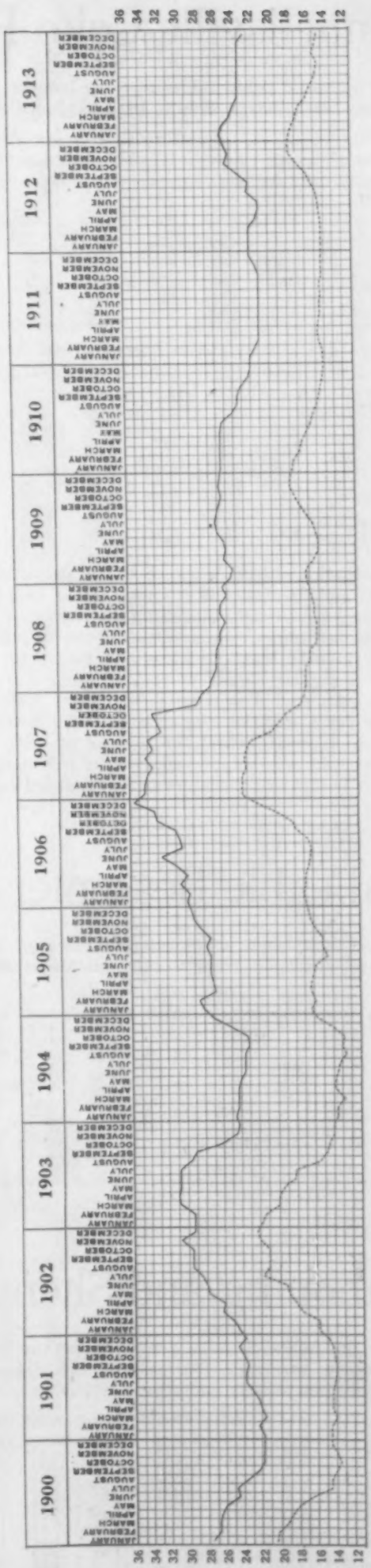


Diagram Showing the Course of Prices of Cast-Iron Water Pipe at New York City for the Past Fourteen Years, Compared with the Course of Prices on Gray Forge Pig Iron at Philadelphia. The Pipe is 6-Inch, Carload Lots, Priced per Ton of 2000 Pounds. The Heavy Black Line Indicates the Pipe Prices and the Dotted Line the Pig-Iron Prices

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The Bureau of Standards at Washington is engaged on some work on segregation in steel ingots, with special reference to the effect on rails. It is using ingots made in the United States and some made in England and is having them rolled into rails so that a comparative examination can be made as to quality.

The chairman of the Peat Association of Sweden suggests that it ought to be possible to add coal dust to peat so that the coal dust could be used in a handy form, while it would also be possible to obtain from the combination a much higher calorific value than from the peat alone.

Connellsville Coke Prices for Fourteen Years

We present below tables showing monthly prices of prompt shipment Connellsville furnace and foundry coke for 14 years, 1900 to 1913, averaged from weekly quotations in *The Iron Age.*

Average Prices of Prompt Connellsville Furnace Coke, per Net Ton at Oven

	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
January	$3.37½	$1.75	$2.90	$5.00	$1.60	$2.46	$2.62½	$3.53	$1.92	$1.59	$2.55	$1.40	$1.82	$3.88
February	3.00	1.75	2.50	5.00	1.52½	2.56	2.14	3.50	1.86	1.59	2.12½	1.45	1.78	2.52
March	3.55	1.90	2.87½	5.00	1.65	2.43	2.24	3.02	1.72½	1.60	2.00	1.55	2.12½	2.40
April	3.56	2.00	2.50	4.20	1.60	2.07½	2.45	2.72½	1.57	1.60	1.77½	1.59	2.39	2.15
May	3.00	2.00	2.50	3.50	1.50	1.87½	2.46	2.16	1.50	1.57½	1.66	1.50	2.28	2.13
June	2.75	1.87½	2.69	3.00	1.45	1.82	2.32½	1.89	1.55	1.52½	1.65	1.42	2.02	2.11
July	2.37½	1.75	3.00	2.50	1.45	1.81	2.51	2.40	1.57½	1.58	1.59	1.44	2.21	2.45
August	2.00	1.75	3.87½	2.25	1.45	1.80	2.76	2.62	1.50	1.66	1.57	1.46	2.21	2.50
September	2.00	1.75	5.00	2.20	1.45	2.10	2.85	2.82½	1.50	2.39	1.60	1.50	2.37½	2.29
October	2.00	1.77	8.00	1.90	1.47½	2.61	2.84	2.85	1.53	2.76	1.59	1.50	3.41	2.08
November	2.00	1.95	6.00	1.75	2.04	2.95	3.13	2.41	1.72½	2.74	1.50	1.52	3.94	1.82
December	1.87½	2.14	6.00	1.62½	2.12½	2.79	3.52½	2.06	1.82	2.67	1.44	1.60	4.00	1.75

Average Prices of Prompt Connellsville Foundry Coke, per Net Ton at Oven

	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
January	$3.50	$2.25	$3.17	$6.50	$2.18	$2.38	$3.42	$4.25	$2.45	$2.00	$2.90	$1.90	$1.97½	$4.40
February	3.31	2.31	3.50	6.50	2.10	2.68	2.65	4.00	2.39	1.95	2.70	2.10	2.09	3.25
March	4.10	2.50	3.50	6.50	2.25	2.75	2.78	3.65	2.25	1.95	2.60	2.05	2.56	3.00
April	3.75	2.50	3.12½	5.50	2.15	2.70	2.95	3.31	2.22	1.86	2.45	2.00	2.69	3.00
May	3.15	2.50	3.15	4.50	2.00	2.55	2.81	3.00	2.03	1.85	2.20	1.81	2.58	2.85
June	3.06	2.37½	2.87½	3.50	1.90	2.40	2.65	3.06	2.00	1.80	2.17	1.76	2.40	2.80
July	2.81	2.25	3.20	3.25	1.80	2.35	2.79	3.00	2.00	2.00	2.15	1.82½	2.40	2.70
August	2.70	2.25	4.25	3.00	1.75	2.25	3.00	3.08	1.92	1.95	2.15	1.85	2.40	2.90
September	2.31	2.25	6.00	2.87½	1.85	2.50	3.19	3.20	1.90	2.55	2.12	1.85	2.54	2.90
October	2.25	2.25	9.00	2.87½	2.00	3.00	3.31	3.25	2.10	2.90	2.10	1.81	3.65	2.81
November	2.25	2.31	7.00	2.50	2.25	3.50	4.00	2.75	2.20	3.25	2.05	1.85	4.25	2.60
December	2.25	2.39	7.00	2.25	2.35	3.50	4.12½	2.50	2.25	3.20	1.97	1.90	4.50	2.50

Attention should be called to the peculiar conditions prevailing in the coke market in the last half of 1902 and the first half of 1903. In all this period coke prices were seriously affected by the extraordinary demand for coke caused by the scarcity of anthracite coal resulting from the great strike of anthracite coal miners which began in the spring of 1902 and was not settled until late in that year. For several months blast furnaces and foundries were greatly hampered in their operations by inability to secure a regular supply of fuel. Prompt furnace and foundry coke at this time sold as high as $11 per ton at oven, and it is possible that even higher price may have been realized. Blast furnaces were often banked for a week or two awaiting coke deliveries, and many foundries ran intermittently. Coke was imported to some extent for the use of blast furnaces and foundries located near the seaboard, and foundry coke was shipped all the way to Chicago from Colorado. The quotations which are above given for this period are therefore to be regarded as to some extent conjectural.

Malleable Bessemer Pig-Iron Prices, Chicago

The table below shows monthly prices of malleable Bessemer pig iron at Chicago from 1900 to 1913 inclusive, averaged from weekly quotations in *The Iron Age,* per ton of 2240 lb.

	1900	1901	1902	1903	1904	1905	1906	1907	1908*	1909	1910	1911	1912	1913
January	$25.00	$15.00	$17.20	$23.24	$14.50	$17.50	$19.37	$26.00	$18.60	$17.09	$19.00	$15.50	$14.35	$17.90
February	25.00	14.87	17.75	23.00	14.50	17.50	19.19	26.00	18.25	16.75	19.00	15.50	14.14	17.31
March	25.00	15.75	18.50	22.87	14.00	17.50	19.00	26.25	17.50	16.50	18.40	15.50	14.00	17.25
April	24.25	16.50	19.50	21.82	14.00	17.50	18.77	26.50	17.50	16.50	17.50	15.25	14.00	17.05
May	23.40	16.45	21.80	20.77	14.00	17.37	18.35	26.60	17.56	16.66	17.06	15.00	14.40	16.00
June	21.12	16.25	22.00	19.50	13.85	16.65	18.00	26.25	17.37	16.50	16.75	15.00	14.50	15.62
July	19.50	16.25	22.75	18.66	13.75	16.37	18.37	25.62	17.50	16.90	16.56	15.00	14.50	14.65
August	17.50	16.30	23.00	17.59	13.75	16.50	18.95	24.80	17.50	17.12	16.50	14.80	15.10	15.00
September	16.12	16.00	24.00	16.94	13.50	16.56	20.12	24.40	17.26	18.50	16.40	14.50	16.25	15.00
October	14.81	15.75	23.90	16.25	13.75	17.37	21.32	22.40	17.00	18.50	16.06	14.50	17.10	15.20
November	14.62	15.81	23.87	15.00	15.87	19.00	24.16	20.25	17.00	19.00	16.00	14.35	17.87	14.87
December	15.00	17.00	24.00	14.50	16.50	19.50	26.00	18.75	17.00	19.00	16.00	14.35	18.00	14.63

*From this time on the prices are given as at furnace near Chicago, and 35c. to 50c. per ton should be added to get the price delivered to Chicago foundries.

Mahoning and Shenango Foundry Iron Prices

In the following table are presented the monthly average prices of No. 2 foundry pig iron at Valley furnace, namely, at furnaces in the Mahoning Valley, Ohio, and the Shenango Valley, Pennsylvania, averaged from weekly quotations in *The Iron Age:*

	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
January	$21.50	$13.20	$15.60	$22.30	$13.00	$16.12	$17.31	$24.60	$16.80	$15.44	$17.00	$13.75	$13.00	$17.50
February	22.04	13.16	16.20	21.95	12.47	16.00	17.25	24.12	16.00	15.06	16.69	13.75	13.00	17.00
March	22.10	13.97	17.76	22.00	12.91	16.00	17.12	24.00	15.56	14.50	16.10	13.75	13.12	16.69
April	21.26	14.10	19.30	20.99	13.01	16.00	16.50	24.00	15.15	14.00	15.62	13.75	13.25	15.55
May	20.30	14.10	19.92	20.32	12.47	15.55	16.30	25.00	14.87	14.19	15.31	13.75	13.25	14.62
June	17.91	13.66	20.60	19.37	11.96	14.81	16.19	25.12	15.00	14.90	14.75	13.56	13.25	14.06
July	16.29	13.20	21.10	18.02	11.67	14.25	16.44	22.80	14.80	15.19	14.31	13.50	13.37	13.87
August	14.42	12.97	22.35	16.34	11.87	14.15	17.71	22.50	14.50	15.31	14.15	13.50	13.69	14.00
September	13.16	13.10	22.30	14.98	11.71	14.56	19.56	20.87	14.47	15.75	13.75	13.44	14.44	14.00
October	12.85	13.60	22.17	14.09	12.50	15.50	21.35	19.80	14.36	17.12	13.94	13.37	16.10	13.84
November	13.35	14.41	23.25	13.32	14.60	16.83	23.87	19.00	15.25	17.25	13.90	13.20	16.94	13.50
December	13.04	15.20	21.25	13.22	16.19	17.35	24.00	17.37	15.50	17.00	13.75	13.00	17.25	13.50

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Lake Superior Charcoal Pig-Iron Prices for Twenty-five Years

The following table, which has been compiled from quotations in *The Iron Age*, gives the average monthly prices of Lake Superior charcoal pig iron per gross ton, in carload lots, at Chicago, from 1889 to 1913:

	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901
January	$20.00	$23.00	$18.50	$17.25	$16.50	$15.50	$13.00	$14.50	$13.50	$12.50	$11.50	$25.50	$19.00
February	19.50	23.00	18.25	17.00	16.50	15.40	13.00	14.00	13.50	11.50	12.50	25.50	17.50
March	19.50	22.50	18.00	17.00	16.50	15.25	13.00	13.50	13.50	11.50	15.75	25.50	17.50
April	19.25	21.50	18.00	16.75	16.50	15.25	12.75	13.50	13.50	11.50	17.00	25.50	18.00
May	18.75	20.50	17.00	16.50	16.50	15.25	13.00	13.50	13.00	11.50	17.25	24.50	17.50
June	18.50	20.50	16.75	16.50	16.00	15.25	13.00	13.50	13.00	11.50	19.50	23.00	17.00
July	18.50	20.00	17.00	16.50	16.00	15.00	13.50	13.50	13.00	11.50	21.50	22.00	17.00
August	18.50	20.25	17.00	16.50	16.00	14.50	13.50	13.50	13.00	11.50	22.50	20.00	17.00
September	18.75	20.25	17.25	16.50	16.00	14.25	14.50	13.50	12.50	11.50	24.25	18.50	17.00
October	19.50	19.75	17.00	16.75	16.00	14.00	15.50	13.50	12.50	11.50	25.00	18.00	17.00
November	20.00	19.25	17.00	16.50	15.75	13.50	15.50	13.50	12.50	11.50	25.50	17.00	17.50
December	22.00	18.75	16.75	16.50	15.50	13.00	16.00	13.50	12.50	11.50	25.50	18.25	18.00

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
January	$19.25	$25.60	$16.62	$18.50	$20.40	$26.80	$22.50	$19.50	$19.50	$17.87	$16.00	$18.15
February	20.25	26.50	15.87	18.50	20.13	27.00	21.38	19.50	19.50	17.50	15.95	18.00
March	20.65	26.50	15.00	18.50	19.75	26.75	21.25	19.50	19.30	17.50	15.75	18.00
April	21.50	25.30	15.19	18.50	19.44	26.50	20.30	19.50	19.00	17.50	15.75	18.00
May	22.80	24.12	15.00	17.75	19.05	27.40	20.00	19.50	18.62	17.25	15.75	18.00
June	23.50	24.00	14.70	17.00	19.00	27.50	20 00	19.50	18.50	16.80	16.75	16.81
July	25.00	22.20	14.50	16.50	19.06	27.00	20.00	19.50	18.50	16.50	16.25	15.65
August	25.75	20.62	14.87	16.40	19.35	27.20	19.50	19.50	18.50	16.50	16.25	14.69
September	26.00	19.00	14.75	16.87	20.13	27.00	19.50	19.50	18.40	16.50	17.12	15.25
October	26.00	18.10	15.31	18.25	21.50	26.20	19.50	19.50	18.12	16.50	18.65	15.25
November	26.00	17.12	16.37	19.20	24.63	25.12	19.50	19.50	18.00	16.50	18.65	15.25
December	25.25	16.50	17.80	20.00	26.13	24.25	19.50	19.50	18.00	16.37	18.75	15.25

Scrap Prices at Chicago, 1903 to 1914

The subjoined tables give the monthly prices o f five leading classes of old material at Chicago from 1903 to 1913, inclusive, averaged from weekly quotations in *The Iron Age*.

Heavy Melting Steel Scrap, per Gross Ton

	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
January	$18.05	$10.13	$14.88	$14.95	$16.80	$11.05	$13.94	$16.00	$11.75	$10.75	$12.60
February	18.13	10.88	14.13	13.63	15.75	12.50	13.56	15.50	12.06	10.75	12.13
March	18.31	11.50	14.45	13.00	16.00	11.44	12.13	15.00	12.15	10.94	12.08
April	18.35	11.25	14.38	13.50	15.75	11.05	12.35	14.44	11.75	11.56	12.50
May	17.63	9.75	12.55	13.70	15.60	10.62	13.44	13.56	10.50	12.05	11.25
June	16.50	9.30	11.95	13.13	16.25	11.62	14.50	13.15	10.38	12.12	10.44
July	16.30	9.00	12.75	13.13	16.12	11.75	14.06	12.38	10.69	11.69	10.50
August	16.00	9.25	13.15	14.10	15.10	12.88	15.00	12.25	11.05	12.25	10.56
September	13.75	10.00	14.38	16.50	14.75	13.00	16.00	12.25	10.70	12.81	10.06
October	12.80	10.88	14.50	16.60	14.70	13.45	16.43	12.25	10.00	13.95	10.00
November	11.25	12.55	15.20	17.50	12.63	14.88	16.00	12.25	9.75	13.69	9.56
December	9.00	14.15	15.25	17.13	11.50	15.17	16.00	12.10	10.25	12.88	9.00

Old Steel Rerolling Rails, per Gross Ton

January	$23.50	$11.75	$16.00	$16.50	$19.00	$12.30	$15.81	$18.00	$13.69	$13.00	$16.15
February	23.50	13.13	15.13	16.25	19.00	13.00	15.12	18.00	13.63	12.80	15.50
March	22.13	13.00	15.30	15.70	19.00	12.19	13.06	17.80	13.65	12.75	15.00
April	22.00	13.00	15.44	15.75	18.50	12.60	13.20	17.69	13.44	12.88	14.63
May	22.13	11.88	14.06	16.00	18.60	12.94	14.44	17.12	13.49	13.50	13.95
June	21.00	10.80	12.95	15.88	18.94	13.94	15.50	16.50	12.38	13.50	12.69
July	19.00	10.31	13.56	15.50	18.00	14.50	15.40	15.88	12.25	13.50	12.25
August	19.00	11.50	14.35	15.90	17.00	15.63	16.12	15.31	12.65	14.00	12.12
September	17.33	11.81	15.25	17.63	16.75	16.18	17.15	15.25	12.75	15.00	12.25
October	15.40	12.38	15.63	18.63	17.15	15.80	18.00	15.25	12.44	16.30	12.15
November	13.50	14.75	16.30	21.15	15.06	17.19	18.00	15.06	12.36	16.50	12.00
December	10.60	16.00	16.50	21.00	12.94	16.95	18.00	14.20	12.50	16.50	11.33

Old Iron Rails, per Gross Ton

January	$24.00	$14.00	$21.13	$23.00	$27.40	$15.60	$18.81	$20.00	$15.00	$15.19	$17.05
February	24.00	16.50	20.00	21.75	25.50	17.12	18.25	19.25	15.25	15.25	16.25
March	24.00	16.60	19.60	20.75	25.00	15.44	16.94	19.00	15.35	15.31	16.25
April	23.75	16.88	19.75	20.88	24.88	15.00	16.10	18.50	14.69	15.56	16.19
May	23.75	15.88	18.50	21.25	24.50	14.81	16.63	17.62	14.69	16.25	15.90
June	21.00	14.65	17.15	21.25	24.50	15.50	17.00	17.00	14.38	16.25	14.75
July	19.70	14.13	17.81	21.25	23.75	15.90	17.00	16.75	14.25	16.25	14.00
August	18.50	15.32	19.35	21.90	20.65	16.56	18.38	16.25	14.25	16.30	14.00
September	17.75	16.00	20.88	23.50	20.25	17.35	19.20	16.00	14.50	16.88	14.00
October	17.00	16.69	22.13	26.00	20.05	18.00	20.75	16.00	13.88	17.95	13.90
November	16.25	20.13	22.90	28.00	17.63	18.38	20.62	16.00	14.75	18.25	13.50
December	13.00	22.00	23.00	28.00	15.50	19.50	20.00	15.70	15.00	17.68	13 16

No. 1 Railroad Wrought, per Net Ton

January	$19.50	$10.85	$18.19	$17.30	$16.35	$11.20	$13.81	$14.88	$11.75	$11.63	$12.70
February	19.50	12.50	17.00	15.88	15.50	12.44	12.88	14.69	12.00	11.30	12.19
March	19.75	12.80	16.40	14.88	15.25	11.25	11.43	14.45	12.30	11.44	12.13
April	20.40	12.50	16.06	14.50	15.25	11.00	11.90	14.19	11.69	12.31	12.38
May	19.13	11.38	14.19	14.50	15.45	10.75	12.81	12.87	11.38	12.75	11.25
June	16.13	10.50	13.50	13.50	16.06	11.69	13.38	12.75	11.25	12.57	10.56
July	14.65	10.44	14.13	13.50	15.06	12.15	13.16	12.44	11.00	12.06	10.55
August	14.19	11.13	15.45	14.50	14.40	12.69	14.44	11.94	11.10	12.50	10.62
September	14.06	11.85	16.31	16.13	14.38	13.44	15.35	11.94	10.94	13.13	10.19
October	13.55	12.50	17.00	17.50	14.60	13.60	15.94	11.75	10.44	14.25	9.60
November	12.00	15.44	17.50	18.00	12.32	14.38	15.31	11.94	10 20	13.50	9.00
December	10.00	17.55	18.00	17.25	11.00	14.83	14.75	11.65	10.75	13.06	8.50

Heavy Cast Scrap, per Net Ton

January	$17.30	$10.50	$13.81	$14.70	$17.80	$12.95	$13.06	$14.88	$12.19	$11.25	$12.90
February	16.63	11.38	13.13	13.50	18.25	13.00	12.75	14.88	12.13	11.25	12.69
March	18.13	12.00	13.40	12.75	19.50	12.12	12.19	14.50	12.25	11.31	12.50
April	17.80	11.13	13.81	12.94	18.88	12.05	12.60	13.69	11.81	12.06	12.44
May	16.75	10.25	12.50	13.40	18.55	11.50	13.31	13.13	11.00	12.20	11.60
June	14.63	8.80	12.40	13.50	18.94	12.00	13.81	13.00	10.75	11.81	10.63
July	14.20	8.94	13.38	13.50	18.44	12.15	13.44	13.00	10.50	11.75	10.70
August	14.00	9.88	13.20	14.00	16.75	12.75	14.06	12.75	10.55	12.15	10.87
September	13.00	10.70	13.38	15.38	16.81	12.88	14.75	12.75	10.10	12.81	10.62
October	12.40	10.05	13.63	15.90	16.25	13.25	15.63	12.50	10.25	14.20	10.40
November	11.63	12.69	14.30	17.50	14.00	13.75	15.12	12.50	10.35	13.50	10.06
December	10.50	14.15	15.00	17.50	13.00	13.92	14.75	12.30	11.00	13.25	9.83

New Iron and Steel Works Construction

Open-Hearth Capacity Now Building, 2,530,000 Tons a Year—That Completed Last Year Represents 2,920,000 Tons

The summary of new construction in the steel industry, which has been a feature of *The Iron Age's* Annual Review Number for several years, is remarkable this year for what it discloses as to the prodigious additions to the country's open-hearth steel capacity. Summing up the information given in detail in following pages we have the subjoined tabulation of the new open-hearth capacity completed in the past year and that which is now under construction.

New Open-Hearth Furnaces Built in 1913

	No. furnaces	Annual capacity, gross tons
Independent companies	37	2,190,000
United States Steel Corporation	14	730,000
Total	51	2,920,000

New Open-Hearth Furnaces Under Construction

Independent companies	29	1,610,000
United States Steel Corporation	17	920,000
Total	46	2,530,000

Practically all the open-hearth furnaces reckoned above as completed in 1913 were put in operation in the year. At the Midland plant of the Pittsburgh Crucible Steel Company two out of the eight new furnaces were not operated, and there may have been other exceptions, but they were few. In the case of the new open-hearth capacity at the Edgar Thomson works of the Carnegie Steel Company only seven of the 14 furnaces are included in the first list above. While the other seven are nearly completed, they have not been operated and thus are counted as under construction. The average capacity of the 37 furnaces built by independent steel companies last year is raised by the two 200-ton tilting furnaces put in operation by the Lackawanna Steel Company, while the average capacity of the 29 independent furnaces now building is raised by two 200-ton tilting furnaces the Pennsylvania Steel Company is building at its Steelton, Pa., plant. The projected open-hearth plant of the Otis Steel Company, at Cleveland, is not included in the estimate of capacity under construction, as the number and size of the units has not been announced. As will be seen from the individual company statements below, all the important independent steel companies have been at work on new open-hearth capacity in the past year.

As to new blast furnace capacity the situation is the reverse of that in open-hearth steel. At no time in many years has so little pig iron capacity been under construction or planned as is the case at the opening of 1914. Of the seven coke blast furnaces reported one year ago as under construction four were put in blast in 1913, as follows:

	Capacity, gross tons
Pittsburgh Steel Company (2), Aug. 5 and Aug. 28.	300,000
Oriskany Ore & Iron Corporation, June 5	45,000
Youngstown Sheet & Tube Company, Sept. 10	150,000
Total	495,000

The list of blast furnaces now under construction is as follows, with expected annual capacity:

	No.	Capacity, gross tons
Bethlehem Steel Company	1	150,000
Minnesota Steel Company	2	280,000
Memphis Mining & Mfg. Company (charcoal)	1	.....
Total coke		430,000

It is a remarkable fact that no new blast furnace construction was undertaken in 1913 apart from the small cold-blast charcoal furnace of the Memphis Mining & Mfg. Company at Winborn, Miss. It was built in about four months and was blown in October 5. The Bethlehem Steel Company furnace noted above was practically completed in December, but as it has not been blown in it is counted as still under construction. The Minnesota Steel Company furnaces will probably not be blown in until 1915.

INDEPENDENT COMPANIES

Cambria Steel Company

The improvements made at the company's various plants at Johnstown, Pa., in 1913 are summarized by departments as follows:

Cambria Plant: New trolley and reinforcement of No. 1 ore bridge at Nos. 1 to 4 blast furnaces; stock yard for Nos. 3 and 4 mills with two 20-ton cranes; additional 15-ton crane for 18-in. mill billet yard; 6000-kw. turbo and condensing system for electric plant; 20-ton rail loading crane, hot saw and changes to rail mill shipping yard; rebuilding and enlarging No. 4 blast furnace, new gas system and stove repairs; tie plate shearing and punching plant at Cambria beam yard.

Gautier Department: 15-ton crane and improvements on 12-in. mill No. 1; extension to 13-in. mill building and additional 15-ton crane.

Rod and Wire Mills: Two field fence machines added and a new bale tie machine.

Mines and Quarries: Safety apparatus for rescue work; two 5-ton electric locomotives for No. 2 Franklin mine; 500-kw. rotary converter for No. 2 Franklin mine; new ventilating fan for No. 2 Franklin mine; electric hoists for No. 1 Franklin mine.

Franklin Plant: New quenching system at coke plant; 750-kw. rotary converter for beam yard power house; 400-ft. extension to blast furnace ore yard; multiple punch and spacing table in car shop; remodeling No. 7 blast furnace, new gas system and stove repairs; rebuilding and remodeling of 50 ovens of No. 3 battery; rebuilding and remodeling of 50 ovens of No. 4 battery.

Corrigan, McKinney & Co.

Corrigan, McKinney & Co., Cleveland, Ohio, late in the year began the erection of the steel buildings for the mills which they expect to have ready for operation early in 1915. Contracts for most of the larger equipment have already been placed. This firm has changed its plans and will not in the present year take any steps toward the erection of a combination rail and structural mill. The building plans for 1914 include the erection of eight 70-ton open-hearth furnaces, a 40-in. blooming mill and a 21-in. and 18-in. continuous sheet bar and billet mill. In connection with the open-hearth plant 23 gas producers will be installed. The plans provide also for the erection of two additional blast furnaces, each 22 x 90 ft., contracts for which, it is stated, will be placed early in the year. Following

the completion of the plant now under construction it is the intention later to add finishing departments, which are to include a rail and structural mill and 8, 11, 14 and 16-in. merchant mills. The United Engineering & Foundry Company will build the blooming mill, and the blooming mill engine will be furnished by the Mesta Machine Company. It will be a 46 x 76 x 60-in. twin tandem compound condensing reversing engine. The Pennsylvania Engineering Works will install a 1000-ton hot metal mixer. The sheet bar and billet mills, together with complete equipment, including shears, tables, hot beds, etc., will be built by the Morgan Construction Company. The gas producers will be furnished by the Wellman-Seaver-Morgan Company. Orders for the cranes and electrical power equipment will be placed shortly.

Otis Steel Company

The Otis Steel Company, Cleveland, has well under way the first of the finishing mills of its new steel plant—a light plate mill, which will be ready for operation early in the summer. This unit will consist of one three-high, 72-in. plate mill in two stands, which will be built by the Morgan Engineering Company, Alliance, Ohio, and two jobbing mills. There will be one 30 x 54-in., one 30 x 60-in. and one 30 x 78-in. roughing mill stand, and two 30 x 54-in. and one 30 x 72-in. finishing stands, that will be furnished by the William Tod Company, Youngstown, Ohio. The crane equipment will be installed by the Alliance Machine Company and the complete electrical equipment by the General Electric Company. Other units to be built after the completion of the light plate mill include an open-hearth plant and a heavy plate mill. The company recently took out building permits for a boiler house, 50 x 100 ft.; a machine shop, 100 x 100 ft.; producer and boiler house, pump house, storehouse, power house and mill, all estimated to cost $389,500, of which $210,000 is for the mill building and $75,000 for the power house.

Upson Nut Company

The Upson Nut Company, Cleveland, increased its steel-making capacity last year by the erection of an additional 65-ton open-hearth furnace, making five in all, and by adding soaking pits and extending mill buildings. Some new cranes and other equipment were installed. In connection with its bolt and nut plant this company is erecting a hot forge shop, 125 x 630 ft. One section of this is about completed and the other section will be built during the year. The work now under way will replace the bolt and nut department buildings with a modern fireproof plant, equipped with cranes and labor-saving and safety devices, increasing the output nearly 100 per cent.

Alton Steel Company

The new plant of the Alton Steel Company at Alton, Ill., built for the rolling of cotton ties, hoops and bands was completed late in the year. The installation comprises an open-hearth plant of two 40-ton stationary, straight-back, open-hearth furnaces, one with basic and one with acid lining; a 32-in. two-high blooming mill, steam driven (formerly installed at Middlesbrough, Ky.) with two Swindell heating furnaces and gas producers; two 18-in. three-high tamdem mills for breaking down; a 12-in. four-stand Morgan continuous mill with 30-ft. Morgan continuous heating furnace; a four-stand 10-in. roughing mill with a one-stand bullhead set, and a four-stand 8-in. mill, with single stand bullhead; the usual machine and blacksmith shops, crane and other auxiliary equipment. The features of the plant will be described more fully in an early issue. The mill is driven with electric power secured from the Keokuk Power Company.

Inland Steel Company

The past year has been one of continuous new construction for this company. Plans for the new work were mentioned a year ago and the extensions are more completely described elsewhere in this issue. They include a 90-in. sheared plate mill, motor driven; a 66-oven battery of Koppers coke ovens, with by-product recovery plant; a battery of 36 Hughes gas producers supplying gas fuel for the open-hearths to displace oil; the enlarging of No. 2 blast furnace from 400 tons daily capacity to 500 tons; the extension of the ore yard for the storage of limestone; the installation of a new bridge, a new skull cracker, a low pressure Westinghouse turbo-generator station and two 14,000,000-gal. turbine water pumps.

Bethlehem Steel Company

The year 1913 has been one of the most active in the history of the Bethlehem Steel Company in improvements and additions to its plant, as is indicated by the following résumé, which covers also work.

LEHIGH PLANT

The company has just completed a new 500-ton blast furnace, known as furnace A, erected on the site of old No. 2 furnace. This furnace, 22 ft. x 90 ft., with five 22 ft. x 100 ft. McClure stoves, now ready to blow in, is a duplicate of the other modern furnaces. It will be blown by two 42 x 60 Bethlehem gas-driven blowing engines, which are erected and ready for operation. One of the two remaining old 200-ton furnaces, which was known as blast furnace C, has been dismantled and will be replaced by another modern furnace, contract for which has already been let. An additional ore bridge is about completed and ready for operation. This increased capacity for handling materials was made necessary by the enlarged blast furnace plant, which will comprise seven large and modern furnaces when the present construction programme is completed. The new ore bridge has a grab-bucket capacity of 14 tons and an over-all span of 550 ft.

NEW MILL FOR HIGH-CLASS STEEL

On the property purchased from the New Jersey Zinc Company, immediately adjacent to the Lehigh plant of the Bethlehem Steel Company, considerable progress has been made toward the erection of a new rolling mill plant for high-class billet, bar and shape output. This installation will consist of a 32-in. reversing blooming mill, driven by a reversing motor generator set, an 18-in. Morgan continuous mill, a four-stand, 22-in. Mesta mill, a 16-in. and 12-in. combination mill, a 12-in. and 8-in. combination mill, and a 10-in. guide mill, the three last mentioned to be furnished by the United Engineering & Foundry Company. All of these mills will be motor driven; in fact, the entire plant is laid out to be operated electrically, no steam or hydraulic power being provided. Contracts for the entire layout, consisting of buildings, mills, motors, cranes, tables, etc., have all been let for some months, and good headway is being made in the erection of these buildings and the installation of the equipment.

The soaking pit and heating furnaces for the blooming mill and finishing mills are being built by the company itself, because they are of special

design required in the heating and handling of the high-grade steels this mill will produce.

An extensive finishing department is also being installed in connection with these bar mills, including cold-drawing equipment, pickling baths, etc. Motor-driven rotary straighteners, cold saws and gag straighteners of various types for squares, rounds and flats are also being provided, as well as complete facilities for annealing and oil and water tempering, which includes the necessary heating furnaces, oil tanks, water tanks and other accessories incident to this work.

Immediately adjoining this building is a commodious warehouse, with a complete set of steel racks for the storage of all this high-grade material. The entire floor space of the finishing building, as well as that of the warehouse, is served by a 5-ton crane in each case. The finishing department and warehouse are complete in every respect, and is the most elaborate equipment for this purpose of any in the country. Paralleling the entire length of the warehouse is a depressed track, for shipping either from various points in the side of the building or directly from the mills by means of a cross crane runway, under roof, between the bar mills and the warehouse and finishing department.

The buildings being erected to cover these mills, soaking pits, etc., are of the most permanent character, and Bethlehem shapes are used throughout. All the buildings are being inclosed with high-grade building brick and steel sash with ¼-in. ribbed wire glass. Concrete slabs are being used for pitched roofs, and for the flat roofs the monolithic concrete roof, with tar and slag waterproofing. The doors are of steel in all cases, of the Kinnear type. It will be noted that no wood whatever is used in the construction of these buildings, and the paving throughout will be of concrete.

The Puddle Mill is being partly rebuilt and two new stands of rolls are being provided. An 800-hp. a.c. motor, to replace the present steam engine, has been purchased for driving the complete mill. The present building will also be dismantled, and a complete new brick and steel building erected in its place.

For the crucible department, 16-in. and 12-in. mills, and 12-in. and 8-in. mills have been contracted for, and will be installed early in 1914. These mills will also be motor driven. The puddle mill building will be extended to include the 16-in. and 12-in. and 12-in. and 8-in. mills. These mills will be especially equipped with furnaces and all other details for handling the high-grade crucible tool steels, and a complete equipment of annealing furnaces will be included in this building.

NEW OPEN-HEARTH FURNACES

In order to furnish additional steel for the new mills six 50-ton open-hearth furnaces are being erected. The foundations are all in place for these and the steel for the buildings is now being set up. These furnaces will make special high-grade steel and alloy steels. In addition to the open-hearth furnaces a 10-ton Girod electric furnace is being built for the making of special steels. This is nearing completion and is expected to be in operation early in 1914.

The buildings erected over these new furnaces are of the same character as the mill buildings above described. The furnaces will be served by a 100-ton Alliance pouring crane, a 60-ton Alliance charging floor crane, and a Morgan charging machine. The gas house will contain Hughes mechanical gas producers, two being provided for each furnace. A Morgan electrical stripper will be installed in an independent building between the open-hearth and soaking pit buildings.

ELECTRIC POWER

Considerable additional electric power will be required for all of these extensions, and this is to be provided by an addition to the electric power station, including four 3000-kw. a.c. generators, driven by Bethlehem gas engines. These generators will furnish current at 6600 volts a.c., this voltage being used directly on all the large motors. A small part of the current, however, will be converted to 240 volts d.c., for crane motors and similar service. A large motor generator balancing set is being installed in the power house, which will be connected to both the a.c. and d.c. systems in such a way as to draw power from either system if it should be required. This power house is now under construction, and the engines are nearly completed in the company's shops.

In order to provide room for the open-hearth and electric furnaces mentioned above, it was necessary to remove the chemical and physical laboratories, and a handsome laboratory building is being completed at the east end of the plant. When finished it will take care of the chemical, physical and metallographic laboratories. When these laboratories are moved into their new quarters, the equipment will be refitted in the most modern manner. It was also necessary to remove the stone building formerly used by the electrical maintenance and repair department, and a new two-story building, 60 x 300 ft., has been erected for this purpose. This building will serve as a repair shop, store room and tool room for the electrical and mechanical departments. The electrical department requires a great deal of equipment to take care of the large electrical installations now in place and under construction.

Adjacent to this building is a new two-story carpenter and pattern shop, of approximately the same size as the electrical and mechanical building, to permit of the present carpenter and pattern shop being used as additional machine shop capacity for manufacturing army field equipment, such as field guns, limbers, caissons and carriages. Both of these buildings have been completed and are now occupied.

In the steel and iron foundries the cleaning departments have been extended and completely bricked in, and in order to furnish additional pattern storage for these foundries a new fireproof, four-story building of brick, concrete and steel has been erected and is now being put into service.

In the machine shops a number of heavy roughing lathes, turret lathes, etc., have been purchased and put into service during the year.

The drop forge department finishing end has been completely rebuilt and equipped with warehouse, heat treatment, and shipping facilities. Six additional drop hammers have also been installed during the year.

A new locomotive repair shop and storage house will be completed within the next month and will be used for repairs and storage of broad and narrow-gauge locomotives and locomotive cranes. This building, 386 ft. long x 70 ft. wide, is a handsome brick and steel structure and contains a 75-ton Alliance crane. The machine tools from the present locomotive repair shop will be moved into this building and a number of additional machines have been purchased.

In the armor plate department an addition of 18,000 sq. ft. has been made to the machine shop for assembling space, and a very heavy pit planer and two grinding machines, all built by the com-

pany, have been installed and are now in operation as well as a new 75-ton Alliance electric crane. A new office building has been erected for the armor plate department.

A new office building has been provided for the joint use of the forge and open-hearth No. 1 departments.

About the middle of the year the very handsome office building erected for the resident United States army and navy officers engaged in inspection work was put into service. Included in this building is a laboratory which has been thoroughly equipped for the United States Government chemists.

The fifth floor addition to the general office building, which includes a large and commodious restaurant, and a number of private dining rooms with full kitchen equipment, was opened up for the annual Christmas dinner to the officers and superintendents of the company on December 22.

The company's stable has been torn down and all of the horses have been replaced by electric storage battery trucks of two to five tons capacity.

During the year 65 steel 100,000-lb. capacity coke cars and 25 100,000-lb. capacity heavy reinforced steel flat cars have been purchased and put into service.

Contracts have been made for two low-pressure steam-driven rotary turbine air compressors, of a capacity respectively of 2500 and 5000 cu. ft. of air per min. These compressors will be driven by the exhaust steam from the hammers in the hammer forge and by the exhaust steam from the pressure pumps in the armor plate department, respectively. Their installation will eliminate a number of other compressors in small units and will effect a considerable economy in steam consumption.

SAUCON PLANT

Six additional 75-ton open-hearth furnaces have been put into service during the year, making a total of 16 furnaces and a total ingot capacity of over 1,000,000 tons per year. This plant can be operated by either the straight open-hearth process, or by the duplex process in connection with the two 20-ton Bessemer converters already installed.

A new 1000-ton mixer has just been put in operation, in addition to the 400 and 250-ton mixers already in service. The new mixer is of a cylindrical type electrically operated, and is the largest in use in any steel plant in the country. It was designed and built by the Pennsylvania Engineering Works, New Castle, Pa.

The electric power station at the Saucon plant has been augmented by the installation of a Bethlehem gas engine, operating on by-product coke oven gas, and driving a 1500-kw. generator. This engine has been working quite satisfactorily since its installation several months ago, using gas from the coke ovens of the Lehigh Coke Company, which are located in close proximity to the Saucon plant.

At the Saucon plant pumping station two additional 18,000,000-gal. pumps are being installed for supplying water to both plants.

The 18,000-hp. boiler house is being completely bricked in and put in excellent shape.

Work has been pushed on the installation of a central scrap breaking and reclaiming plant, located on the present cinder dump, and these plans include the removal of all the present scrap drops to this point, together with the installation of an additional crane and crane runway.

An additional set of soaking pits has been installed to heat the increased amount of steel made by the open-hearth furnaces.

There are now being installed two additional heating furnaces for the 28-in. structural mill.

A new blacksmith shop has been erected and put in service in this plant.

A new warehouse for the various products of the company, such as tool steel, staybolt iron, special steel shapes, bars, etc., has been erected and put into service at Boston in connection with the Boston sales office.

Pennsylvania Steel Company

The following is an outline of the new construction this company now has under way at Steelton, Pa., much of it well along toward completion. Additional equipment is being provided throughout the works to take care of the new capacity:

Extension to open-hearth plant providing for one 75-ton stationary furnace, two 200-ton tilting furnaces and two 20-ton Bessemer converters.

Four-story brick building to house the general works offices.

Extension to forge plant which will be equipped with one 2000-ton steam hydraulic press, with required heating and annealing furnaces.

Coal-washing plant.

Additional equipment for electrical power plant, including 2500-kw. steam turbo set, including transformers, etc.

Remodeling 13-in. mill, including replacement of steam engine by 600-hp. electric motor.

Finishing shop for rail joints, tie plates and other track material.

United Steel Company

The United Steel Company, Canton, Ohio, built last year two new 80-ton open-hearth furnaces, making seven furnaces in all, and installed a 10-in. and a 20-in. electrically driven bar mill. In connection with these mills a full line of equipment, including hot and cold saws, was provided. This company also placed in operation a new heat treating plant.

Lukens Iron & Steel Company

This company has under construction at Coatesville, Pa., a 50-ton open-hearth steel furnace which will increase its output by 20,000 to 25,000 tons a year. It will be completed by the spring of 1914. A new two-story fireproof store room and oil house is also being added.

John A. Roebling's Sons Company

In 1913 the John A. Roebling's Sons Company completed and put in service at its open-hearth plant at Roebling, N. J., three additional melting furnaces of 40 tons capacity each. Additional capacity was also provided in the blooming mill. Increased heat treating equipment was installed at both the Trenton and Roebling plants and the power plants at both Trenton and Roebling were added to during the year. The removal of the wire cloth department from Trenton to the new buildings at Roebling was completed and the capacity materially increased.

Colorado Fuel & Iron Company

About the middle of 1913 the Colorado Fuel & Iron Company began the construction of three additional open-hearth furnaces at its Pueblo, Col., plant. These will bring the open-hearth plant up to a total of 15 furnaces, rated at 50 tons each. Work on the new furnaces will be completed early in 1914.

La Belle Iron Works

The outlays of the La Belle Iron Works, Steubenville, Ohio, on addition and improvements in 1913 amounted to $250,000 to $300,000, the new work including a variety of small buildings, crane runways and equipment. A new 50-ton open-hearth furnace was completed in July. An entire new feed water heating system was installed.

Lackawanna Steel Company

At the No. 2 open-hearth plant of the Lackawanna Steel Company, the construction of which was started in 1912, the two 200-ton tilting furnaces were completed and placed in operation in the early part of this year. This plant is located north of and adjoining the Bessemer steel works and the tilting furnaces operate on the duplex process. An extension is now being made to this plant which eventually will comprise eight large furnaces of the stationary type. The foundations for all eight furnaces have been installed and four furnaces, together with extension to the building, are now being erected. In connection with the construction of the stationary furnaces a stock yard about 650 ft. long has been provided, served by two 10-ton, 100-ft. span cranes. Stock is loaded into boxes on charging cars at ground level and pushed up a trestle to the charging floor of the furnace plant.

For the No. 2 open-hearth plant there has been built a calcining plant for burning lime. It is housed in substantial steel buildings and consists of three 8-ft. by 125-ft. rotary kilns using pulverized coal for fuel. In addition to the kilns is a complete equipment of coal and stone crushers, conveying machinery, storage bins, etc.

A second 165-ton ladle crane has been installed at the No. 1 open-hearth plant, and a building 350 ft. long erected over the mold yard at this plant, equipped with a 15-ton crane for the changing of molds.

For taking care of the ladle skulls, etc., produced by No. 1 and No. 2 open-hearth plants, a central skull cracker plant has been installed, consisting of a steel frame runway, 70 ft. span and 90 ft. long, served by a 50-ton crane. The ball used for breaking up skulls weighs 15 tons and is handled by a special magnet suspended from the crane hook. The hight from the ground to crane rail is 60 ft.

NEW PIT FURNACES

The company has built a four-hole soaking pit furnace at the rail mill and is now adding another, which will make a total of seven at this mill. At the finishing end of the rail mill there has been installed a 25-ton 66-ft. span crane equipped with special magnets for loading rails for shipment.

A new four-hole soaking pit furnace is being installed at the slabbing mill known as mill No. 4, making a total of six furnaces at this mill. The company has under construction at No. 6 merchant mill a 150-ft. extension to the south end of the mill building, to be used for the storage of billets. Alterations and improvements are being made to the hot bed and shear table at No. 6 mill which will greatly improve the shearing and loading facilities.

The blooming mill is being extended 75 ft. and a four-hole soaking pit furnace installed, which will make a total of five furnaces for this mill. The blooming mill gas producer house is being extended and a Hughes mechanical producer installed.

BOLT, NUT AND SPIKE PLANT

There was completed and placed in operation in the early part of the year a bolt, nut and spike plant for the manufacture of track bolts and spikes. This is contained in a brick and steel building of fireproof construction, 138 by 200 ft. There are three automatic spike machines, also a small hand spike machine, the latter being used for making small or special spikes. For the manufacture of bolts there is one Ajax automatic roll feed bolt header and two reciprocating roll threading machines. For making nuts there are two 1 in. and one 1½ in. hot pressed nut machines, together with necessary burring and tapping machines, etc. The furnaces for heating steel are of the Ferguson type and use crude oil for fuel. The plant has a total annual capacity of bolts, nuts and spikes of about 28,000 tons.

The company has also built and placed in operation a small briquetting plant for the recovery of blast furnace flue dust. It has one briquetting press, together with auxiliary apparatus, and briquettes are manufactured by the Schumacher process.

A brick and steel electrical repair shop, 65 by 200 ft., is under construction. A number of heavy duty machine tools were added to the machine shop equipment, and at the roll shop two large heavy duty necking lathes.

Youngstown Sheet & Tube Company

Important new construction was completed in 1913 by the Youngstown Sheet & Tube Company, Youngstown, Ohio, besides extensions and improvements to existing departments. Blast Furnace D—the fourth stack to be built by this company—was blown in September 9. The furnace is 16 ft. in diameter through the hearth; 22 ft. in diameter through the bosh; 88 ft. high from hearth level to top platform, and has a nominal capacity of 500 tons in 24 hours. In connection with the furnace were installed four Kennedy two-pass center combustion stoves 22 ft. in diameter by 102 ft. high, with common chimney provided for the battery. The ore yard was extended 587 ft. x 207 ft. 9 in., making an additional storage capacity of 360,000 tons. Nine ore and nine coke bins were added to the stock bin system, making an extension of 126 ft. Eight 502-hp. Rust water tube boilers were added to the boiler plant.

NEW STEEL PLANT

The new open-hearth plant, containing six 100-ton furnaces, was started up last year. The first heats were taken out of these furnaces on the following dates: Furnace No. 1, May 1; furnace No. 2, May 2; furnace No. 3, June 3; furnace No. 4, July 6; furnace No. 5, August 10; furnace No. 6, September 6. There are 18 Hughes mechanical gas producers. In the Bessemer department has been installed a Southwark-Rateau turbo-blower with a maximum capacity of 45,000 cu. ft. of air per minute against 30-lb. pressure and running condensing on a 108-in. Helander barometric condenser. The old horizontal reciprocating engine is retained as a spare.

Blooming mill No. 2 is a 44-in. mill driven by a Mesta 46-in. and 76-in. x 60-in. heavy duty, twin tandem, compound direct connected reversing engine, running condensing on a 120-in. Helander barometric condenser. With this mill were installed a Wellman-Kennedy hydraulic slab manipulator, slab-transfer, 20 x 20-in. steam-hydraulic down-cut slab shear and runout table, 10 x 10-in.

hydraulic bloom shear, runout table and transfer. With the original installation were built five 4-hole regenerative type pit furnaces, with Treat hydraulic covers. One additional furnace is now under construction. To the pit furnaces for blooming mill No. 1 is now being added one new furnace of the same type as the above.

SHEET, TUBE AND WIRE MILLS

In connection with the sheet mills the additions are the following: A new sheet bar storage building of steel construction 158 ft. 9 in. x 103 ft. 2 in., containing a Morgan 15-ton 100-ft. span crane and two vertical shears with a capacity of 325 tons in 24 hours; an 84-in. Helander barometric condenser; a Morgan 50-ton, 73-ft. 2-in. span crane in the main building; a Morgan 10-ton, 63-ft. 2-in. span crane in warehouse No. 1; a paint shop of sufficient capacity to paint the sheets from all the mills, served by one Cleveland 10-ton 45-ft. span crane.

For the tube mill a new pipe storage yard of two parallel crane runways 457 ft. long and 76 ft. 8 in. span has been provided, making an effective storage space of 50,000 sq. ft., which is served by two Morgan 10-ton double hoist cranes. There is a telpherage system, amounting to 2006 lineal feet, of which 716 ft. is for scrap handling and 1290 ft. for handling pipe between the threading floors and galvanizing departments. On these runways operate three Northern 10-ton monorail electric trolleys. The threading floors, Nos. 1 and 2, have been extended 2700 sq. ft. to provide better shipping facilities. Five gas producers at producer house No. 6 have been replaced with five Chapman 10-ft. rotary producers. The socket shop has been extended over 16,650 sq. ft. area.

An addition to the nail mill of brick and steel construction covering 17,763 sq. ft. has been built, 3988 sq. ft. of this being used for machine shop and 13,775 sq. ft. for a nail mill in which were installed 48 nail machines with accessory equipment. To the field fence department have been added six staple lock fence machines; to the wire mill, one 12-block and one 7-block wire drawing frame. This plant is subdivided into the rigid department, in which is made black enamel and electro-galvanized conduit, and the flexible department, in which is made armored flexible conduit and armored hose. The buildings cover an area of 27,575 sq. ft.

FILTRATION, PUMP AND POWER PLANTS

The new filter plant now under process of construction is the Wm. B. Scaife & Sons We-Fu-Go water softening and purifying system. It has a capacity of 4,000,000 gal. per 24 hr. and consists of eight steel filters 15 ft. in diameter, of the gravity type, and eight steel reaction tanks 30 ft. diameter and 26 ft. high. The water is pumped into the reaction tanks by a Wilson-Snyder single stage, direct-connected, motor-driven centrifugal pump. The treated water from the reaction tanks flow by gravity into the filters. The purified water from the clear well under the filters is pumped to the various feed-water heaters by a Wilson-Snyder single stage centrifugal pump geared to a Kerr turbine. The filters are covered by a building of steel, brick and concrete construction 104 ft. by 45 ft. The entire plant covers an area of 17,600 sq. ft.

No. 10 pump house, a new department, contains three 20,000,000-gal. Wilson-Snyder horizontal direct-connected, motor-driven centrifugal pumps and is covered with a building of brick and steel construction 27 ft. 6 in. x 72 ft. 6 in. In this building is a 10-ton Northern hand power crane. The building also contains the electrical transformers and switch board for the open-hearth plant.

To power house No. 3 has been added an extension covering 1386 sq. ft. in which are located two new 1000-kw. motor-generator sets.

Boiler house No. 3 has been extended 110 ft. for the installation of five 500-hp. Stirling water-tube boilers. Each boiler is equipped with a Sanford-Riley underfeed forced draught stoker. At this boiler house there is also being provided an additional ash hoist. The old reciprocating boiler feed pumps are being replaced with two Worthington centrifugal pumps geared to Kerr turbines, and the old feed water heater is being replaced with a new heater 9 ft. diameter by 35 ft. long, nominal rating 25,000 hp. This is an intermittent heater and operates on exhaust steam from No. 1 blooming mill engine.

A general fire protection system has been installed at the main plant in East Youngstown. There are 46 4-in. two-outlet fire hydrants and two miles of 8-in. water mains in which is carried 150 lb. working pressure. The water is supplied by three 18 and 10 x 12-in. Fairbanks-Morse underwriters' standard reciprocating fire pumps with a capacity of 1000 gal. per min. each, and one 8-in. Worthington centrifugal pump with a capacity of 1800 gal. per min.

The company has purchased in the year 60 100,000-lb. standard gauge steel cars and one 70-ton standard gauge locomotive for use in this plant.

The new office and miscellaneous buildings include a riggers' building of brick, concrete and steel construction, two stories and basement, each story having floor space of 4294 sq. ft.; also the tube office building of brick, concrete and steel construction, three stories and basement, each story having a floor space of 2158 sq. ft.

Allegheny Steel Company

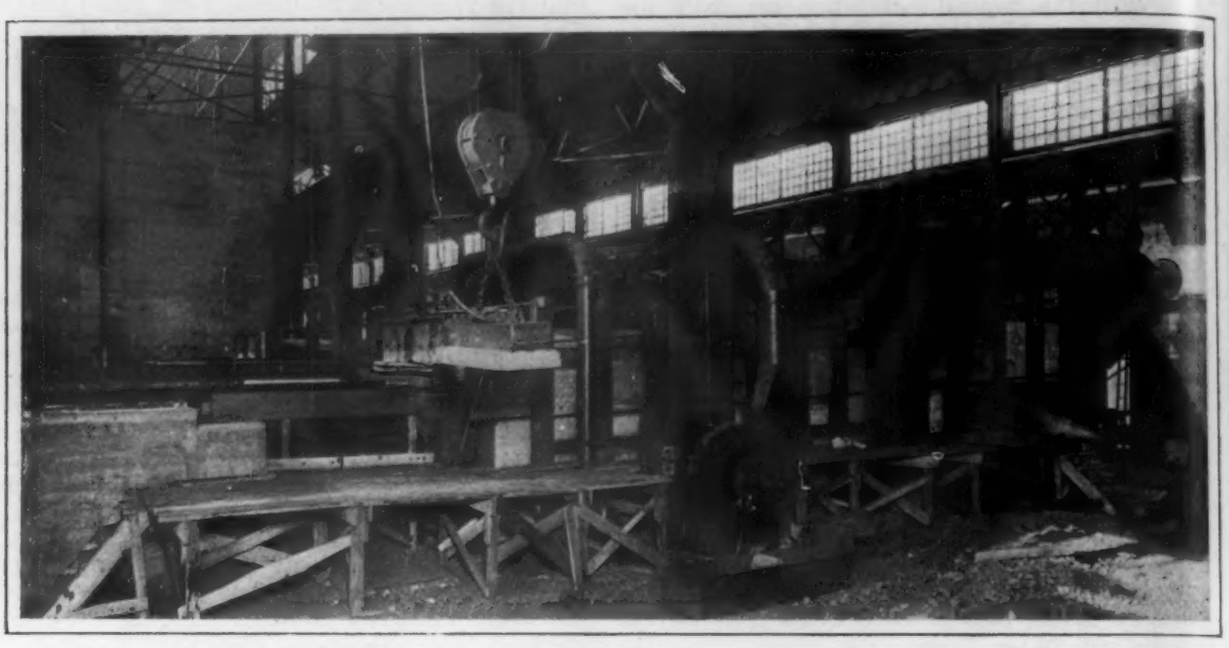
Additions were made as follows to the various departments of the Allegheny Steel Company's plant at Brackenridge, Pa., last year: To the open-hearth department one 75-ton Siemens-Martin basic open-hearth furnace, producing approximately 40,000 tons per year. To the steel casting department, buildings, tools and appliances increasing the output about 200 tons per month. To the stamping and blanking department, tools and buildings, increasing the output 100 tons per month. To the power plant, one 1500-hp. high and low pressure steam turbine.

Wisconsin Steel Company

At its South Chicago works this company is just completing a new bar mill of an improved Belgian type, comprising an 8-in. mill of two stands, 12-in. mill of five stands and 14-in. and 16-in. roughing stands. The nominal capacity is 2500 tons a month. The mill has a Corliss tandem compound steam engine drive. At the same plant a concrete ore dock 1300 ft. long has also been completed. In connection with the beehive coke oven plant previously in operation at Benham, Ky., 100 additional ovens of the same type have been added this year. The Agnew mine, one of the Mesaba range properties of the company, hitherto operated as a stripping mine, is being converted to a milling proposition. The shaft is being constructed and electrical haulage installed in the pit.

(Continued on page 118)

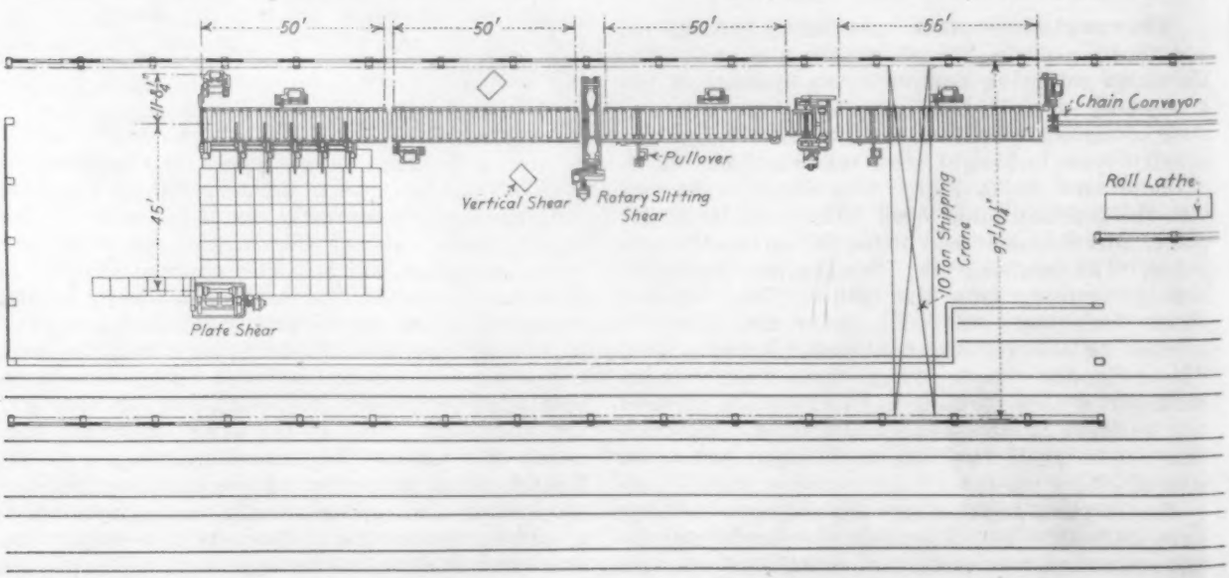
Heating Furnaces from the Charging End, Showing the Handling of the Slabs by Crane and Magnet to the Charging Pusher



Inland Steel Company's Plant Extensions

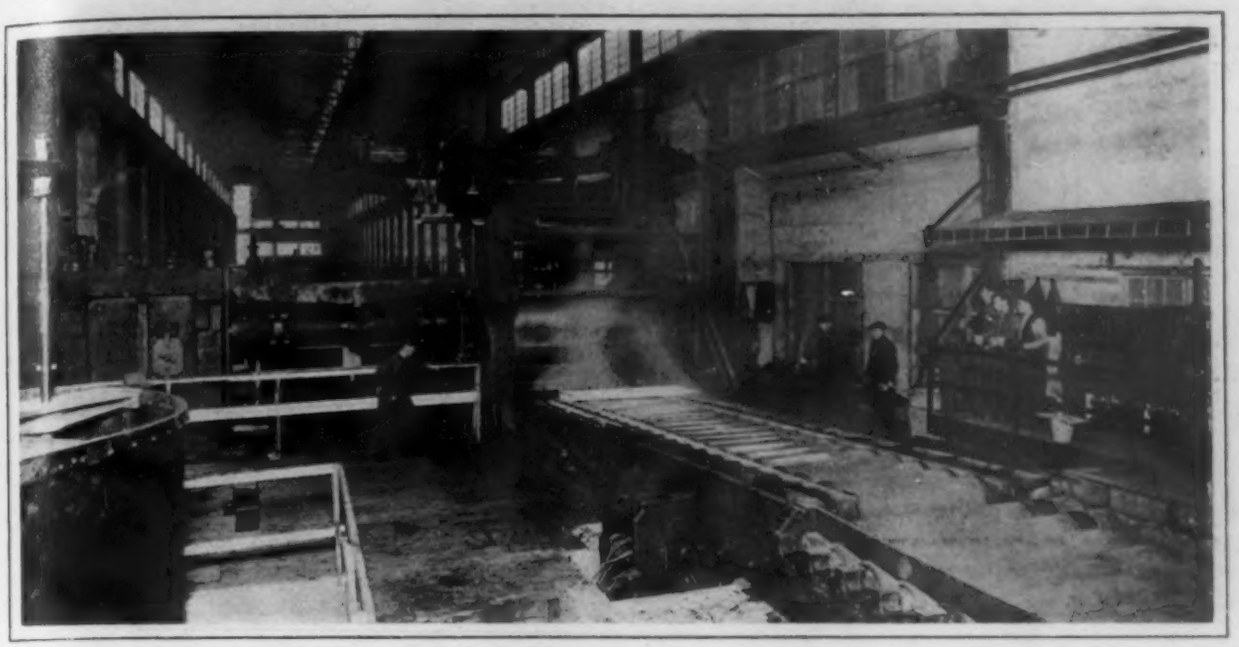
The Continued Remarkable Growth of the Indiana Harbor Plant Toward More Diversified and Balanced Output and Independence in Raw Materials

Important extensions have been made at the Harbor Works of the Inland Steel Company the past year. These changes and additions will make for more efficient power and fuel factors, for larger tonnage and greater diversity of product and for further intrenchment of the operation as a self-contained unit. The most important new construction includes a 90-in. sheared plate mill and a Koppers by-product coking plant of 66 ovens with the Koppers direct-process installation for by-products recovery. The need of more hot metal and ingot capacity to provide for the increased output of finished steel has been met by enlarging the No. 2 blast furnace and by the installation of four additional 60-ton open-hearth furnaces. The question of fuel for open-hearth and heating furnaces, which promised to become critical for this company, using oil as it did almost exclusively, has been relieved by the erection of a battery of Hughes gas producers for the open-hearth plant and by making the necessary connections for the burning of the coke-oven waste gas in heating furnaces and boilers. Power for the new plate mill is provided for by the installation of a low-pressure turbo-generator station, which will also supply sufficient current to allow supplanting the steam drive for the sheet mill with an electric motor gear drive. A natural handicap in the layout affecting the free handling of materials and the future growth of the plant is also being materially reduced. The Harbor works are bisected by the



THE OPPOSITE ENDS OF THE NEW PLATE MILL

Plate Mill from the Approach Side Showing the Manipulation of the Slab to Get Desired Width. Operating Pulpit at the Right



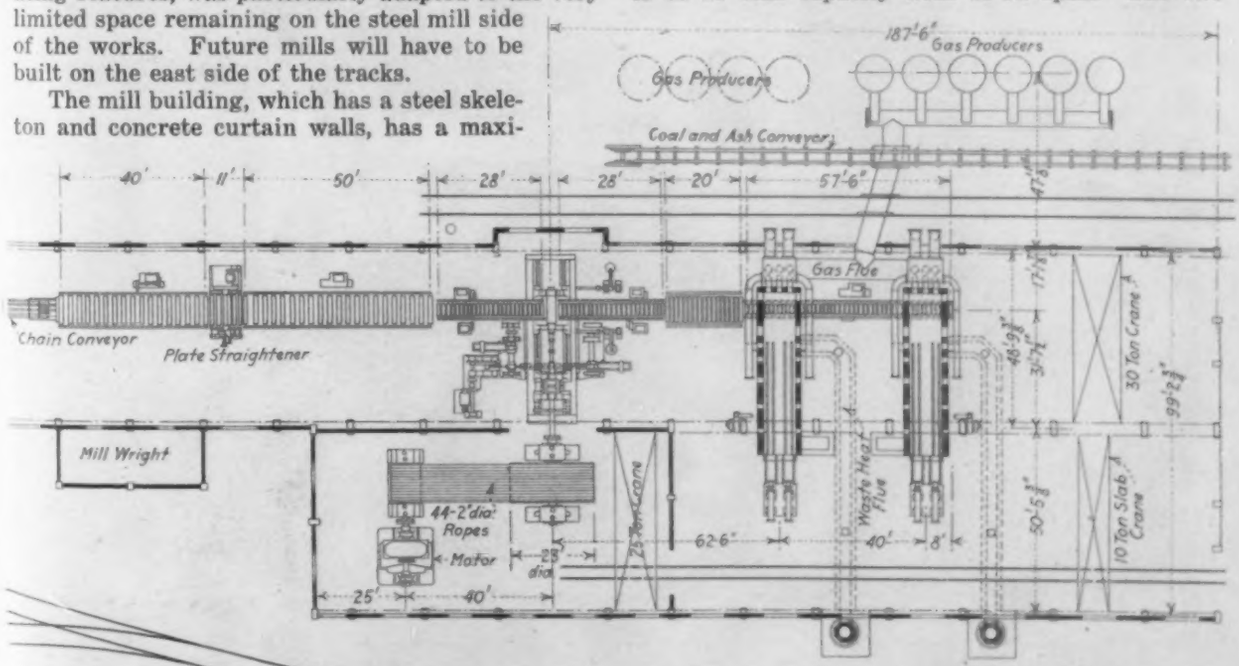
tracks of several trunk lines, in a measure isolating the pig-iron plant on one side from the steel mill on the other, the plan of the one shown on page 37 and that of the other on page 36. The hot-metal tunnel at the north end of the works has been built for some time, but intercommunication with standard equipment has required switching through the interlocking system of the trunk lines. A tunnel is now being completed to provide double track and clearance for standard equipment.

THE NEW PLATE MILL

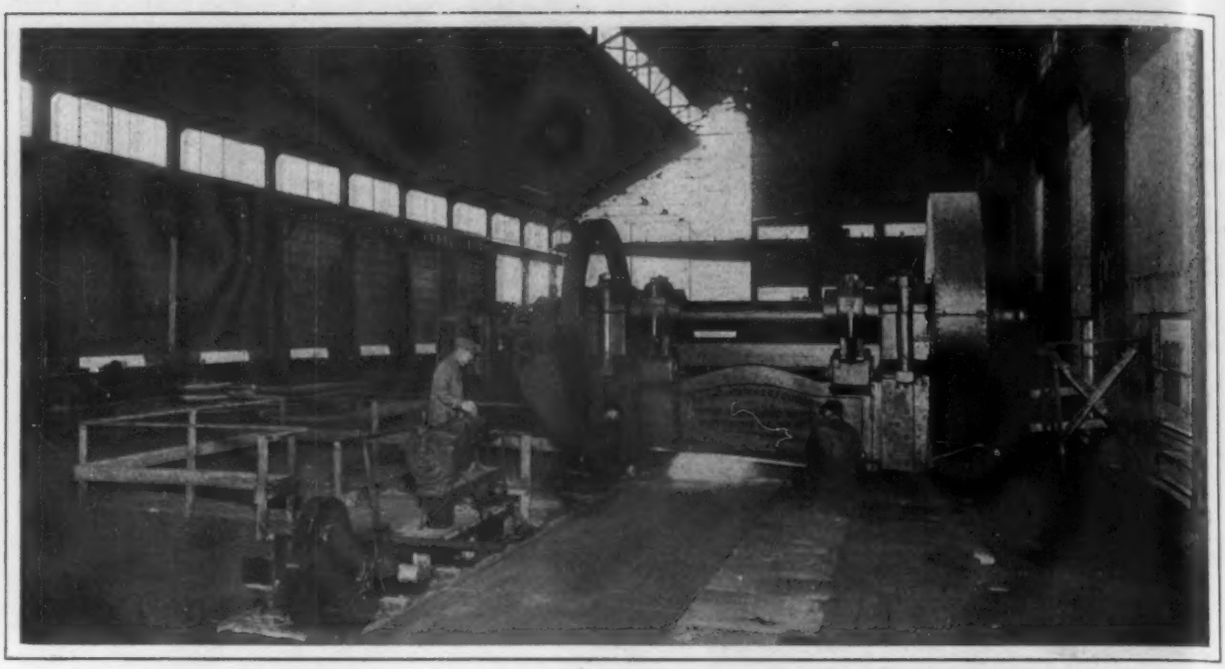
The new plate mill will have a capacity of 8000 to 10,000 tons a month and is especially well adapted for rolling car plates. The general arrangement of the mill and run-out tables is presented in the accompanying drawings. This straightaway layout, aside from its desirable operating features, was particularly adapted to the very limited space remaining on the steel mill side of the works. Future mills will have to be built on the east side of the tracks.

The mill building, which has a steel skeleton and concrete curtain walls, has a maximum width of a little over 99 ft. It is 857 ft. 6 in. long. The building and the entire mill were erected by the Inland Steel Company's engineers. The heating furnaces are of the Alex. Laughlin & Co. continuous type and the mill pinions and mill tables were furnished by the United Engineering & Foundry Company, which company also supplied the guillotine shears. The drive was built by the Mesta Machine Company, employing Westinghouse motors. The pulpit control was installed by the Electric Controller & Mfg. Company. The rotary shears were furnished by R. S. Newbold & Son Company and the mill cranes by Alliance Machine Company.

Slabs from the blooming mill are brought into the end of the plate mill on the narrow-gauge tracks and unloaded for temporary storage and for subsequent transfer to the furnace charging table by crane and magnet as here shown. The slab crane is of 10 tons capacity with 48-ft. span. The two



CONNECTED BY A CHAIN CONVEYOR 248 FT. LONG



The 110-in. Guillotine Shear for Cutting Plates to Length. A View from the Mill Side Showing a Plate Squared for the Cut

continuous heating furnaces, placed 40 ft. center to center, are equipped with hydraulically operated pushers and are supplied with fuel gas from a battery of six Laughlin producers. The furnaces have a chamber 9 ft. wide and 14 ft. 6 in. long. The slabs are carried on water-cooled pipe trays, the heated slab being kicked out as the cold slab is pushed into the furnace, the operation being controlled from the pulpit in the usual manner. Temperatures up to 2800 deg. are possible in these furnaces, and under normal conditions they will each heat in a single turn slabs for rolling about 125 tons of finished plate. The producers like the furnaces are of standard type and will deliver about 1000 lb. of gas per hour. The furnaces run on four producers leaving two spares. The furnace tables deliver the heated slabs at the rate of 254 ft. per minute to the mill approach table, the rollers of which are geared to the same speed.

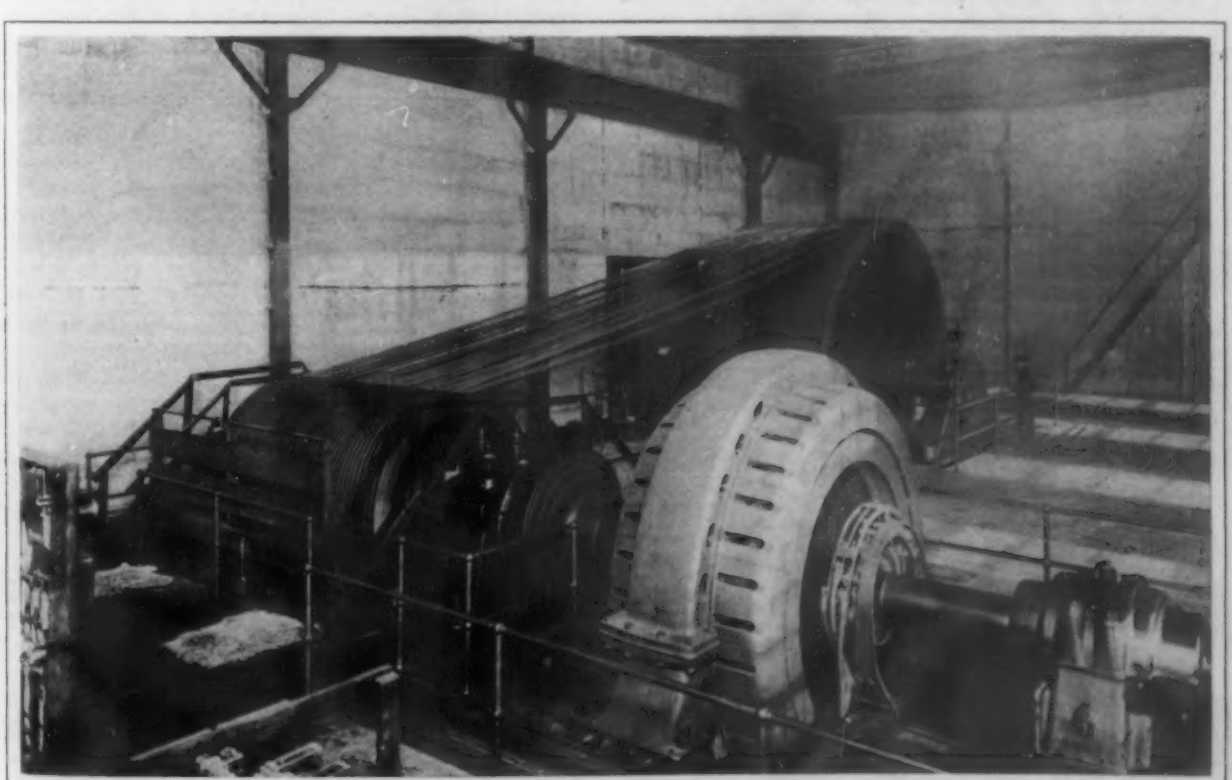
The mill proper is of standard design, of the 90-in. three-high type, with electrically operated front and back tilting tables, each 28 ft. long and speeded for 168 ft. per minute. The top and bottom rolls have a diameter of 32 in. with necks 23 in. in diameter. The middle roll is 22 in. in diameter and controlled with hydraulic power. The screwdowns are separately driven with a standard motor drive. The mill has rolled a 3700-lb. plate and will roll to an extreme width of 80 in. and an extreme length of 50 ft., the plate thickness varying between No. 8 gauge and ¾ in. The mill is driven from a 2000-hp. Westinghouse motor operating at 245

At the Left is the Inspection Cradle Showing a Plate in Process of Being Turned Over and at the Right the 110-in. Slitting Shear and Loading Tracks

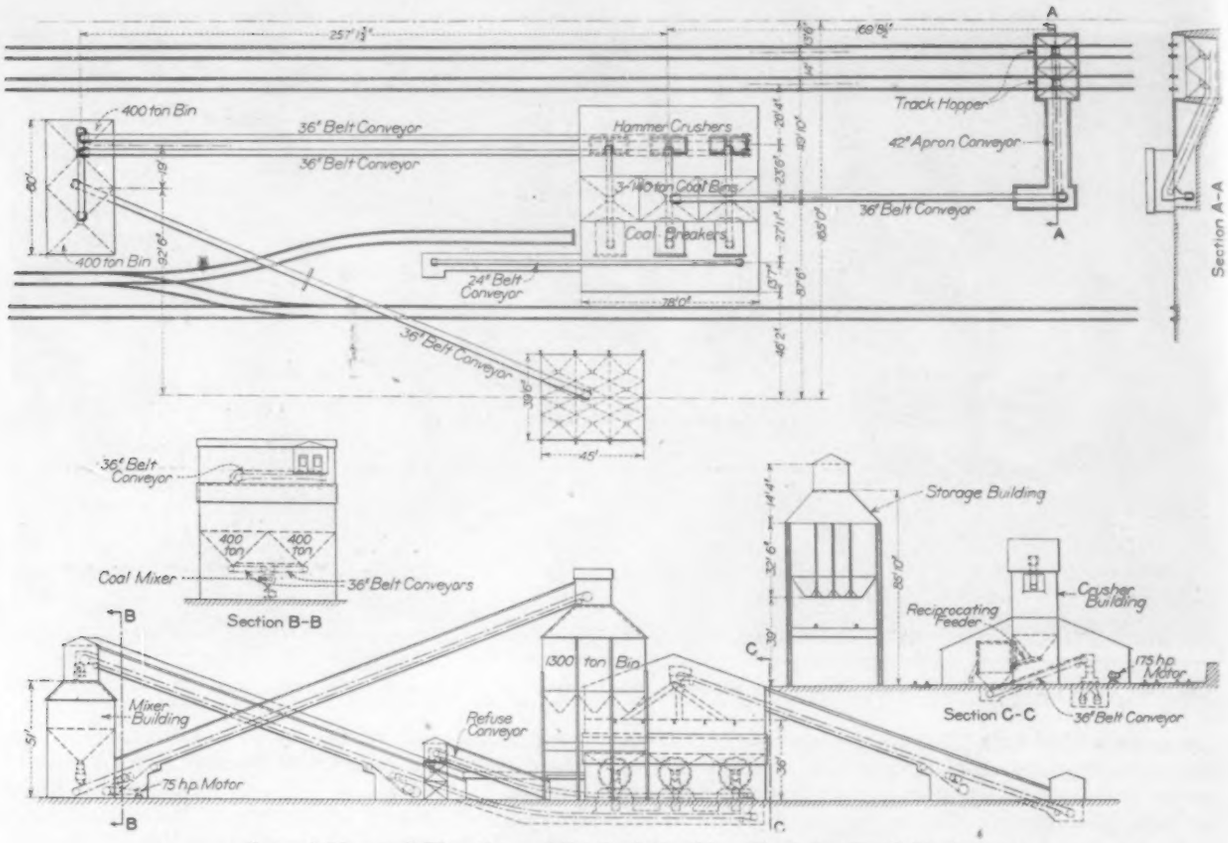
The Two Rotary Shears Arranged to Shear the Plates to Width as They Come, Cut to Length, from the Guillotine Shear

r.p.m. on a 2200-volt, 25-cycle, 3-phase current from the low-pressure turbo-generator station. The motor is connected up with a rope drive of 44 2-in. strands, the driving sheave having a diameter of 7 ft. 4 in. and the driven sheave 23 ft., reducing the speed to 80 r.p.m. The large sheave weighs 120 tons and the flywheel effect is sufficient to carry the mill over without reduction in speed on an overload approaching 50 per cent. The sheaves are located at 40 ft. centers. A departure from the more common practice has been made in the use of machine cut pinions, and a material reduction in back lash, with a corresponding increase in the steady pulling characteristics of the mill, is claimed as a result. The sheave speed of 80 r.p.m. is brought down to 51 r.p.m., which is the mill speed, through the pinions. All of the drive bearings are of enclosed ring oiled design and the mill turns over on a friction load of about 250 kw. The tilting tables are operated from a 100-hp. motor and are equipped with a hydro-pneumatic equalizer carrying a pressure of 225 lb. The mill scale drops into a concrete pit and is washed out through a conduit into the settling basin common to the other mills. The room in which the drive is enclosed is spanned by a 25-ton crane and the mill room is served by a 30-ton crane.

From the mill the plate is delivered to the plate straightener approach table, 50 ft. long. The plate straightener is of standard United Engineering & Foundry Company design with 5 top and 6 bottom rolls handling the plate at a speed of 82 ft. per



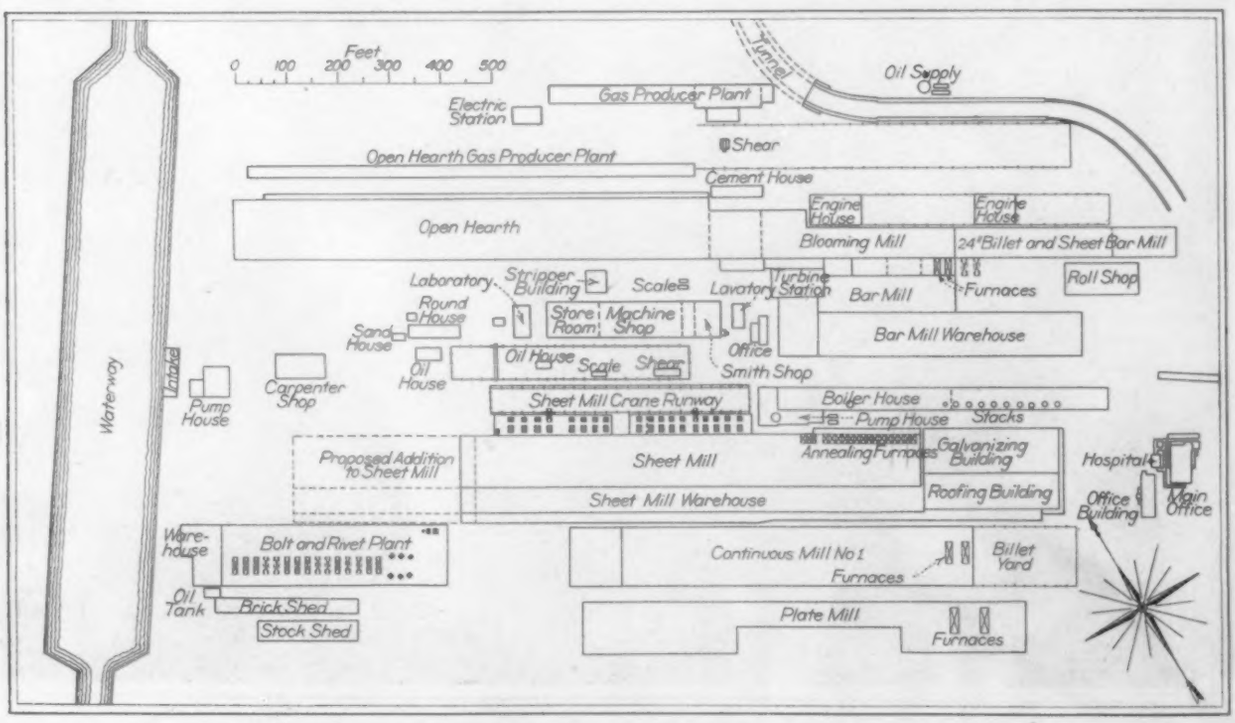
The English System Rope Drive and 2000-hp. Alternating-Current Motor Installed for Driving the Plate Mill. The Driven Sheave is 23 Ft. in Diameter



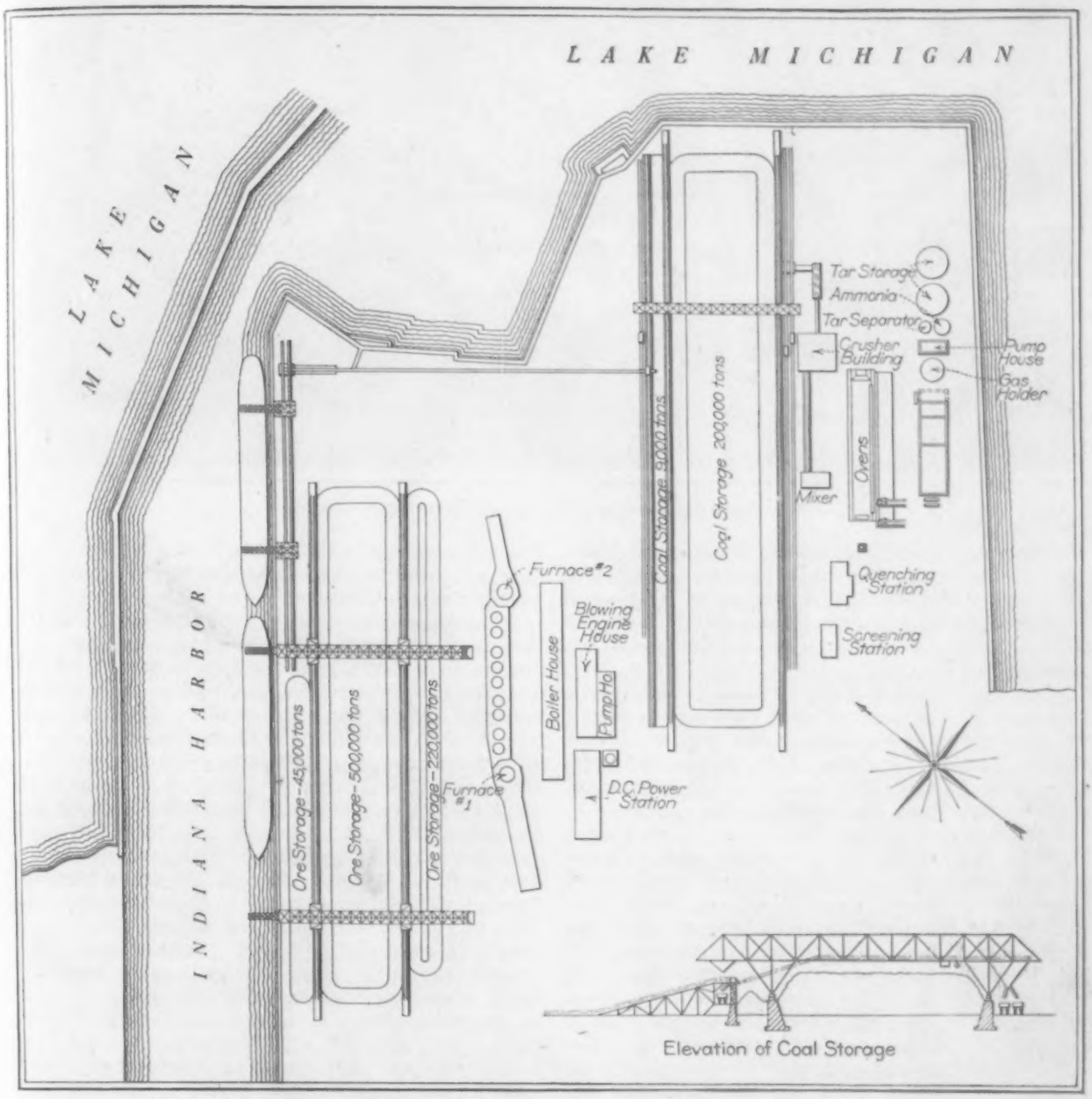
General Plan and Elevations of the Coal Crushing Plant for the Coke Ovens

minute. The back straightener table is 40 ft. long and delivers the plates to the chain conveyor which has a total length of 248 ft. On this conveyor the plates cool off, are given a surface inspection and are marked for shearing to size. The shear table is 55 ft. long and the shear 110 in. wide with capacity for shearing 1-in. plate. The table is equipped with a pull-over to assist in squaring the plates for shearing and where possible, as in the rolling of the lighter plates, pieces are cut at this shear to a minimum length of 8 ft.

The shear runout table carries the plates to two rotary shears, one on each side of the runway. One shear is stationary and the other is mounted on adjusting screws with motor drive and pulpit control so that plates from the maximum widths down to 30 in. and less can be sheared for width without additional operations. The shear table is fitted with a pull-over and a sliding dog which grips the plate and holds it in alignment during the shearing operation. A variation of not more than 1/32 in. in width is regularly attained on maximum length plates. On either side of the runout table from the rotary shears vertical scrap shears have been installed which cut the trimmings from the plate into lengths suitable for the open-hearth charging boxes



No. 1 Plant of the Inland Steel Company, Showing Location of the Plate Mill



No. 2 Plant of the Harbor Works, Showing Pig Iron and Coke Plants

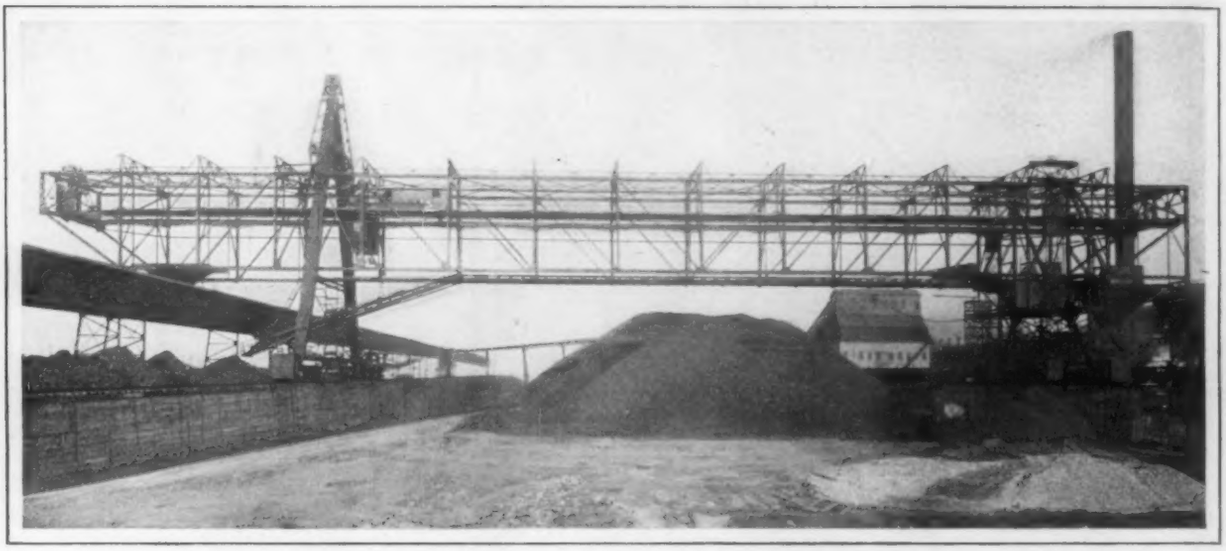
that are brought over to the plate mill for loading.

In an accompanying illustration is shown a view of the inspecting and transfer device installed for handling the plate from the runout tables to the castor plates on which a final inspection is given and also on which the plates are manipulated for splitting to smaller sizes on the 110-in. splitting shear which is a duplicate of the mill shear above mentioned. The nature and operation of this device is in large measure apparent from the illustration. Two sets of rocker arms spaced 8 ft. on centers are mounted on shafts parallel to the tables, one set of arms interlacing with the rolls of the mill table and the others extending into the castors. The plate is lifted up, turned over and laid on the castors for the inspection of the reverse side. In connection with the inspection of the plates for thickness at the center and on the edges, an electric signalling installation connects this end of the mill with a group of three lights, red, white and blue, in view of the plate roller. The white light indicates that the plates are coming through within the limits of variance, the red light shows them to be too heavy in the middle and the blue light indicates the plates are off gauge on the edges. These signals effect a quick check on the mill to be subsequently followed by an exact adjustment. A plate piler is installed at the end of the mill runout tables for the plates that are sheared to size without transfer to the splitting shear.

The shipping room is spanned by a 10-ton crane equipped with a plate handling magnet, and the depressed shipping track, which traverses one side of the building for a length of 300 ft., will accommodate simultaneously about seven cars. The mill equipment also includes a 50-in. motor-driven roll-turning lathe and also a portable roll-turning device for trueing the rolls without removal from the mill housings.

THE NEW POWER STATION

The power station from which the current is obtained for the mill drive consists of two 2000 kw. low-pressure Westinghouse turbo-generators, equipped with regenerators, designed to work at atmospheric pressure and capable of delivering current for a 100 per cent. overload. A Wheeler condensing plant is installed. Steam for this turbine plant is supplied from the 50 x 66-in. reversing engine, which drives the 36-in. blooming mill and also from the 34 x 48-in. twin reversing engines driving the bar mill. In addition to supplying current for



General View of Coal Storage and Bridge with Robins Conveyors

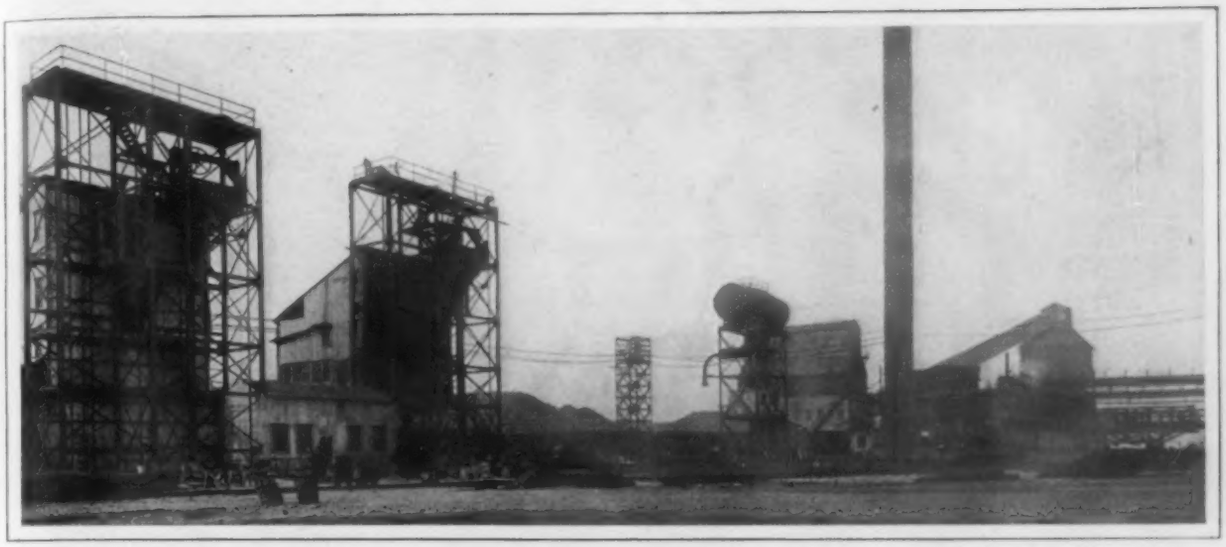
the plate mill drive, this station is making it possible to take out the 34 x 60-in. twin steam drive for the No. 1 sheet mill and to install in its place a 1600-hp. alternating-current motor drive. A similar geared motor drive will later be installed also, at the other end of the mill.

For the steel mill at Chicago the making of its own coke in a by-product plant represents a saving of approximately $1 a ton in the cost of its hot metal. This saving varies of course with the price of coke at Connellsville ovens and becomes an especially important matter when the Connellsville prices touch such high points as are not infrequent. It is, in fact, of more importance to eliminate the fluctuations of the market from consideration and to be able to develop a quality of coke which most exactly and consistently meets the particular requirements of the individual concern than to effect only the dollar and cents saving under average coke market conditions. The installation of the battery of Koppers by-product coke ovens having a daily capacity of 1290 tons was thus a logical step in the policy of owning and operating its own sources of raw material, which the Inland Steel Company has so consistently pursued. The general layout of the coal handling and crushing plants, the battery of 66 ovens and the direct-process recovery installation is shown in the accompanying illustrations. The coal handling equipment was designed and erected by the Robins Conveying Belt Company and the coal crushing plant by the Link Belt Company. The conditions to be met required the incorporation of some unusual features.

The coal storage is nearly 800 ft. from the vessel dock and the coke ovens an additional 390 ft. Tracks have been laid on the dock on which two 30-ton electrically operated coal unloaders are installed equipped with 3-yd. grab buckets. The unloaders are rated to break down a hatch at a speed of 150 to 200 tons per hour. The coal is discharged from the bucket into a hopper from which it is dropped through foot valves into 30-ton larry cars built by the Atlas Car & Mfg. Company. In these self-contained electrically operated cars the coal is transferred from the unloaders to the track hoppers through which the coal is fed to the belt conveyors. The 36-in. belt conveyors consist of three legs known as conveyor A, B and C with a three-way hopper, shown in one of the cuts, as a common point. Conveyor A extends from the track hoppers on the docks over to a point alongside the storage yard, a distance of 769 ft. This conveyor delivers coal at the rate of 350 tons an hour running at a speed of 350 ft. per minute. From the elevation at which the three-way hopper is mounted the coal delivered by conveyor A may be discharged into cars on tracks which parallel the storage yard, into conveyor B running 435 ft. parallel to the storage yard to the north, into conveyor C which parallels the storage yard running 715 ft. in a southerly direction or directly on conveyor D, which is carried by the coal bridge, assuming the bridge to be properly located. Conveyors B and C are equipped with trippers so that the coal may be discharged at any point in the length of the coal storage, either into the 35-ft. storage trench which parallels the retaining wall and has a capacity of 9000 tons, or on the bridge conveyor.

Robins Coal Conveyors Where Conveyor A Discharges Into the Three-Way Hopper

The coal storage is 225 ft. wide and has a storage capacity of 200,000 tons. The



Screening Station, Quenching Station, Mixer Building and the Battery of Coke Ovens

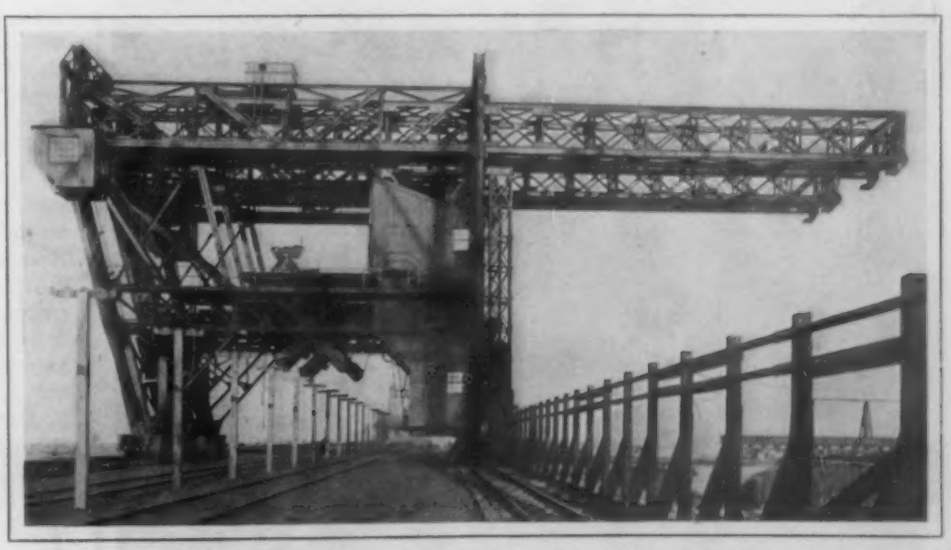
bridge which spans the yard has a clearance of 45 ft. As already mentioned, coal may be received on the 36-in. conveyor which traverses the bridge, at any point either for loading into storage or for direct transfer to the cars on the coke oven side of the yard. The bridge has a rated loading capacity of 350 tons per hour and a capacity for reclaiming coal, for which it is equipped with a 5-yd. bucket, of 200 tons per hour.

The cars operating on the double tracks which parallel the coal storage on the east or coke plant side are the connecting link between the coal handling and the coal crushing plants. The layout of the crushing plant is shown on page 36. From the cars the coal drops through track hoppers to a 42-in. apron conveyor which carries the coal across 50 ft., to a 36-in. belt conveyor with a capacity of 400 tons per hour on which the coal is elevated into the two hoppers of the crusher building. Each hopper has a capacity of 140 tons. By means of a reciprocating feeder the coal is fed from each hopper into a 12 x 14-ft. Bradford breaker, coal being handled at the rate of 200 tons per hour. The refuse from the breakers is discharged upon a 24-in. belt conveyor and elevated to a refuse tower from which the refuse is loaded into cars. The coal from the breaker drops onto a 36-in. inclined conveyor and is carried over to the hammer mills, of which three are installed. Both the breakers and hammer mills were furnished by the Pennsylvania Crusher Company, Philadelphia.

Through two-way spouts the crushed coal from the mills is discharged onto two 36-in. conveyors and is carried up into the two 400-ton bins of the mixer building. The arrangement of equipment and conveyors in parallel for handling the coal through the crusher building and to the mixers provides for the two grades of coal used. From the foot valves of the two mixer hoppers the crushed coal is brought together on two 36-in. belts, each with capacity to deliver 100 tons per hour to the coal mixer. The coal mixer delivers to a 36-in. belt conveyor that carries the coal up to the 1300-ton storage bin from which the oven larries are loaded. From the storage yard to the coke larries the coal moves in process of crushing and mixing an approximate distance of 875 ft.

The coking plant proper is a battery of 66 horizontal cross-regenerative type ovens, each with a content of 540 cu. ft. and with capacity for a charge of 13¼ tons of coal. The coal chamber is 37 ft. long between doors, 9 ft. 10⅝ in. high and with a width tapering from 18½ in. at one end to 21 in. at the other. The battery is designed to operate on a coking time of 16 hr. As in the Gary plant the gas collecting main above the ovens is placed at one side but instead of a continuous main fitted with a mechanical scraper, it is built in two sections, each sloping somewhat from the blind ends at the center of the battery and each section having its separate collecting take-off. To keep the main free of pitch it is flushed with tar and is fitted with cleanout covers at frequent intervals. The charging larries are of the four-hopper type corresponding to the four charging openings in the oven.

The ovens are equipped with the inserted type of door, the use of which promotes a better coking of the coal at the ends of the oven. An electrically operated trolley and carriage with suitable lifting



Coal Unloading Towers for the Coke Oven Plant at Inland Steel Harbor Works

Leveling and Pusher Machine, Pusher Side of Koppers Coke Ovens, and By-Products Recovery Building

claws traverses the length of the battery on the discharge side and removes and replaces the doors without manual handling. On the pusher side the doors are manipulated with the pusher. Of these machines there are two, one to be used as a spare. They are of the type furnished by the Alliance Machine Company and are combined levelling and pushing machines. The ovens are worked in a series of eleven, the sequence being 1-12-23.

In accordance with common practice at the more recent oven installations the quenching of the coke is remote from the ovens, thus eliminating the delays and possibility of danger to which the clouds of steam give rise. The screening station consists of two duplicate units in which rotary type screens are used as contrasted with shaker screens at the Gary plant.

The ovens will operate on a coal mixture consisting of 30 per cent. Pocahontas and 70 per cent. Pittsburgh coal from which a coke production approximating 75 per cent. of the coal charged is being secured. The production of surplus gas for use in the mill is likewise an important item in the operation of the ovens, and they are now yielding about 5500 cu. ft. of surplus gas (other than is required for heating the ovens) per ton of coal charged or at the rate of 11,500 cu. ft. of total gas per ton of coal. The yield of crude coal tar is about 7½ gal. per ton of coal and of ammonium sulphate about 23 lb. per ton of coal, tar and ammonium sulphate being the only forms of by-product manufactured.

The Koppers direct-process installation is housed in a brick building which parallels the ovens. In this building the apparatus is arranged in two complete and parallel units, the one set being used as a spare. The gas passes first into the cooler where all condensates are precipitated whence it is drawn through centrifugal exhausters and forced into the tar extractors. Reheating follows with subsequent passage into the saturators from which the sulphate is lifted by ejector into the ordinary centrifugal dryers, of which there are two for each saturator. The ammonium sulphate produced contains a minimum of 25 per cent. ammonium and is of unusual whiteness in color. The most obvious advantage in connection with the direct-process plant is the small amount of labor required for operation, three men constituting the entire crew. Operation of the coke oven and by-product plants was begun on November 8 and has been continued without cessation, the initial product being of standard quality and character.

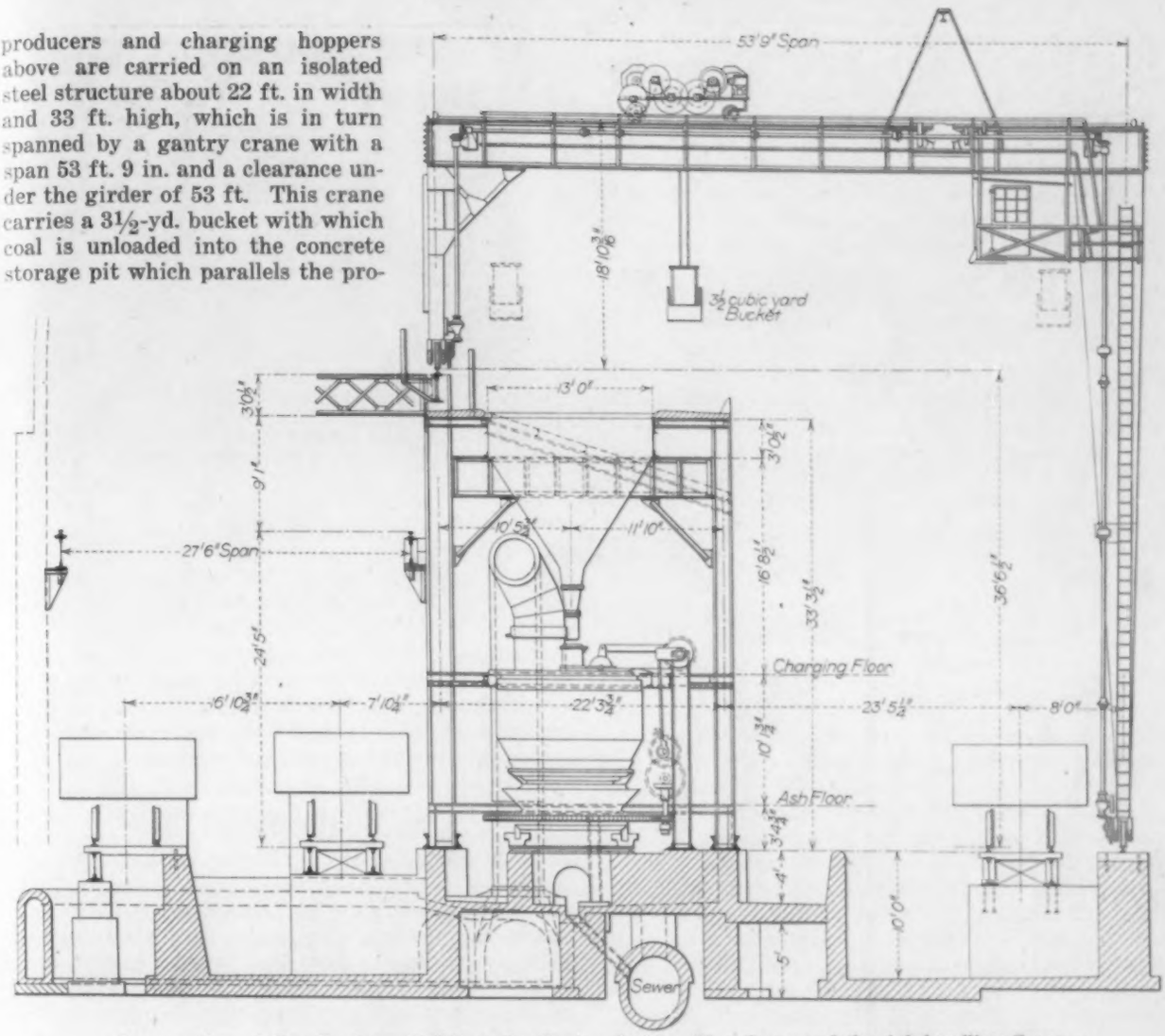
A two-stage installation of Buffalo centrifugal blowers raises the pressure of the surplus gas to 2½ lb. in the gas main which delivers the gas to the mills for heating purposes. While all of the furnaces which are to be operated on this gas are not yet changed over from fuel oil, it is the programme to use the gas for the two furnaces in the 24-in. bar mill, the annealing furnaces in the sheet mills, the two jobbing furnaces in the sheet mill, for all of the furnaces in the bolt and rivet plant and under the boilers.

Charging Floor of the Open Hearth Gas Producer Installation

THE GAS PRODUCERS FOR THE STEEL PLANT

The gas-producer installation for the open-hearth furnaces is a battery of 36 Hughes 10-ft. mechanically poked producers arranged in a line paralleling the open-hearth building. The producers are grouped in batteries of three for each open-hearth, the gas being carried over to the furnaces through foundation conduits. The general characteristics of the installation are evident from the accompanying cross-section and the views here shown. The

producers and charging hoppers above are carried on an isolated steel structure about 22 ft. in width and 33 ft. high, which is in turn spanned by a gantry crane with a span 53 ft. 9 in. and a clearance under the girder of 53 ft. This crane carries a 3½-yd. bucket with which coal is unloaded into the concrete storage pit which parallels the pro-



Cross-section of Gas Producer Building, the Gantry Coal-handling Crane and the Ash-handling Crane

ducers and is again reclaimed and elevated into the charging hoppers. On the side of the producers, opposite the coal storage, a 5-ton Alliance ash handling and service crane operates along the full length of the batetry.

ENLARGEMENT OF NO. 2 BLAST FURNACE

The enlargement of the No. 2 blast furnace, which involved the increase of the hearth diameter from 14 ft. 6 in. to 16 ft. 6 in. and increased the daily production of the stack from 400 to 500 tons, is interesting with relation to the altered lines of the boshes. This can be most plainly observed by comparison of the cross-section with that of the furnace as it was formerly, as illustrated on page 1154 of *The Iron Age*, May 9, 1912. Since the resumption of operations with this furnace a much smoother action has been observed. Internally water-cooled steel castings segments have been used for the hearth jacket, the pieces having a thickness of 6 in. The binding at the tuyeres has been accomplished with 1¼-in. steel plate in three segments, giving to the boshes an unusually neat appearance.

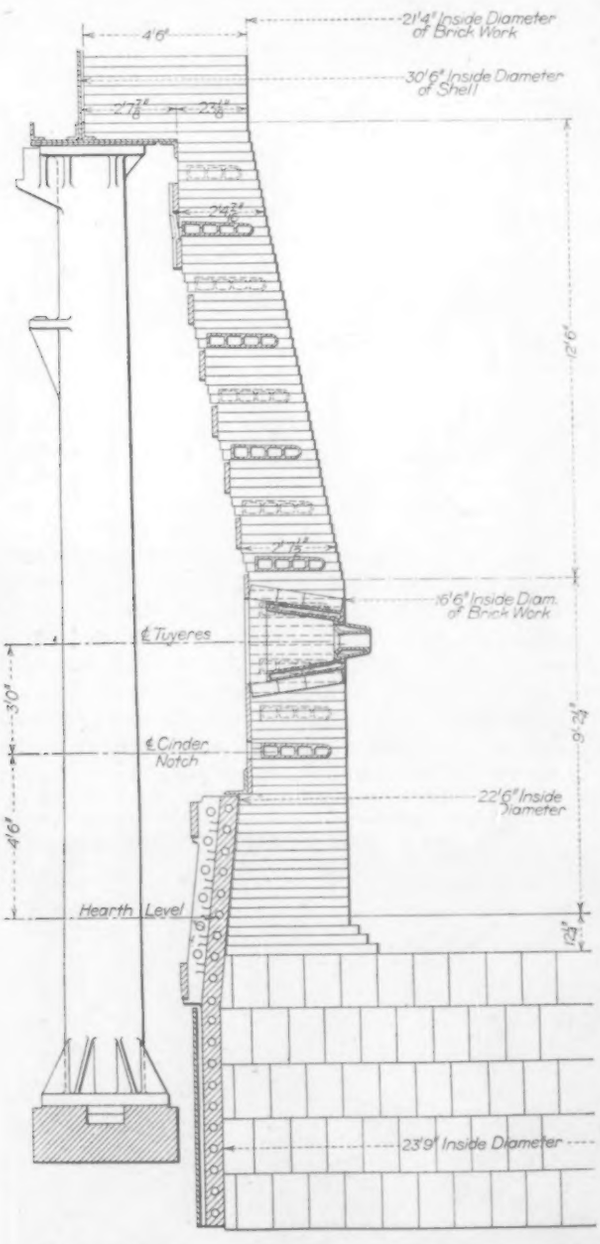
Incidental extensions of less importance include the addition to the ore storage yard, 200 ft. long and 180 ft. wide, which will be used for the storage of limestone, to be received in the future by boat. The yard will have a storage capacity of 90,000 tons and will be spanned by a bridge not yet installed. A skull cracker with a span of 65 ft. and carrying a 25-ton Cleveland crane has also been erected.

A word of explanation may perhaps be made re-

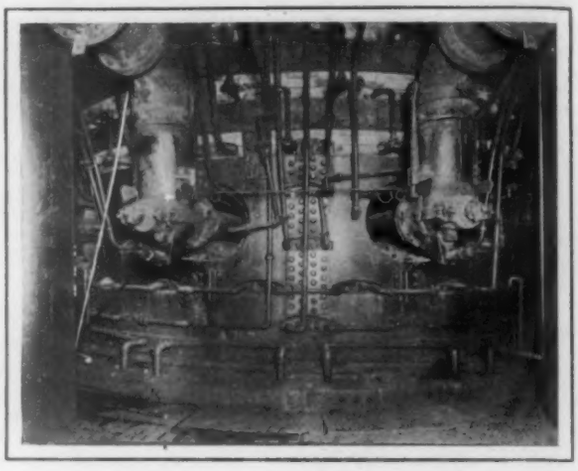
Gas Producer Building and 5-Ton Service Crane and Grab Bucket

garding the maps printed on pages 36 and 37. The area mentioned as the No. 1 plant lies immediately below the area covered by the No. 2 plant, with the trackage of a number of the through railroad lines between the two. The rearrangement of the works' tracks and the means of communication between the two plants by means of the tunnels indicated in the map of the No. 1 plant is not shown. Nor is the nearby town site with the viaduct over the tracks for the employees.

Some data may also be given on the coal crushing plant for the coke ovens in addition to that indicated on the drawings on page 36. The 42-in. apron conveyor from the track hopper, with a speed of 40 ft. per minute and a capacity of 400 tons an hour, is driven by a 20-hp. motor. The 36-in. belt conveyor taking from this is driven at a speed of 400 ft. per minute, with 400 tons hourly capacity, by a 50-hp. motor. The short 36-in. belt from each breaker to the hammer crushers is driven at a speed of 225 ft. per minute, for a capacity of 200 tons per hour, by a 5½-hp. motor. Each of the two belts which take the crushed product and the belt from the mixer building to the storage building have a speed of 200 ft. per minute and a capacity of 200 tons per hour, driven by a 75-hp. motor. The former are 300 ft. long on centers, and the other about 257 ft. long from center to center. All the lifting belts are inclined 20 deg.



Cross-section showing the lines and construction of the Boshes and Hearth of the enlarged No. 2 Furnace. Compared with the previous cross-section, shown on page 1154 of *The Iron Age*, May 9, 1912, the inside diameter at the hearth level is 16 ft. 6 in., an enlargement of 2 ft., while the enlargement of diameter inside of the jacket is only 6 in. or 22 ft. 6 in. The inside diameter of the brick work of the shell or shaft is 21 ft. 4 in. against 20 ft. 6 in. in the older form, with a wall thickness of 4 ft. 6 in. instead of 4 ft. 10½ in.



Steel Plate Jacket and Circulating Water Connections at Boshes of No. 2 Furnace

Coal Production in 1913

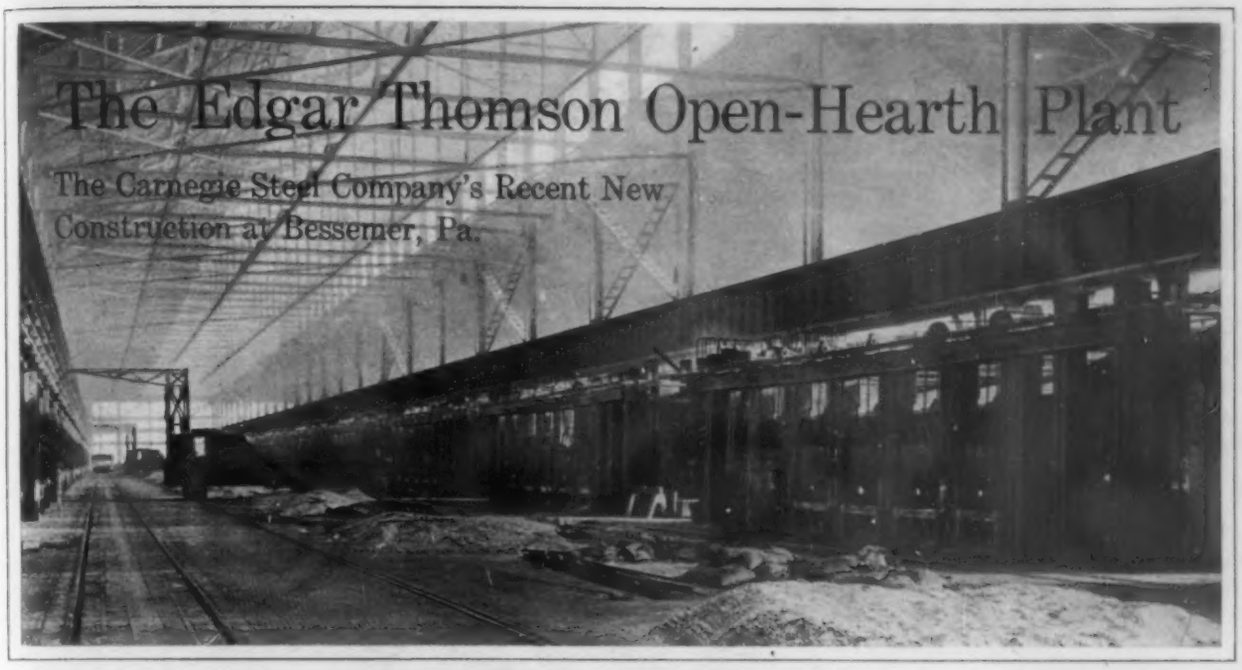
A production between 565,000,000 and 575,000,000 net tons of coal in the United States in 1913 is the official estimate of Edward W. Parker, coal statistician of the United States Geological Survey. This is an increase over the record-breaking production of 1912 of 30,000,000 to 40,000,000 tons. Of this increase about 4,500,000 tons was in the production of anthracite.

There were a few labor disturbances in 1913, but they were local in extent and effect. The most pronounced disaffection was in Colorado, where a general strike was called about the middle of September and the production in that State in the last quarter of the year was little more than 50 per cent. of normal. There was general complaint, particularly in the Eastern States, of shortage of labor and inability on the part of operators to keep their mines working at full capacity. This was probably the reason for less than the usual complaint of the inadequate or insufficient transportation service.

This deficient labor supply was an important factor, however, in enabling operators to maintain prices. It prevented an output in excess of market requirements, which would have added one more to numerous preceding years when prices were demoralized by an excessive supply. As it was, there was a slight advance in prices, compared with 1912.

Steel Corporation Shares to Employees

Employees of the United States Steel Corporation will be afforded this month the opportunity of subscribing to the corporation's common stock at $57 a share and the preferred at $105 a share under the profit-sharing plan put into effect several years ago. The stock may be paid for in instalments. The corporation has set aside 25,000 shares of each class of stock for subscription, but it is stated that this does not mean that the men will be limited to these amounts. A year ago the corporation sold 34,551 shares of preferred and 25,793 of common to its workers at $66 for the common and $109 for the preferred.



The Edgar Thomson Open-Hearth Plant

The Carnegie Steel Company's Recent New Construction at Bessemer, Pa.

The Charging Floor Showing the Charging Machines

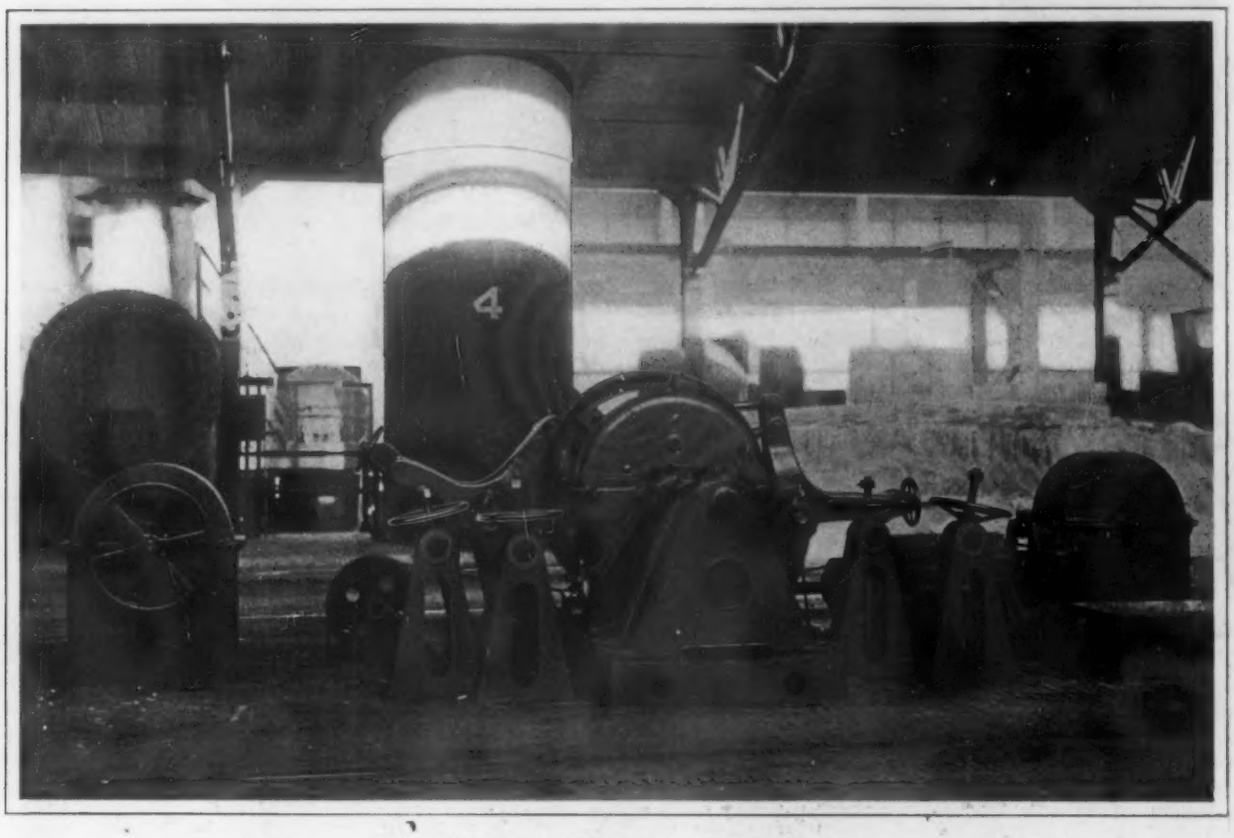
THE Carnegie Steel Company of Pittsburgh has practically completed building a new open-hearth steel plant at Bessemer, Pa., containing 14 furnaces, each with a capacity for 80 to 100 tons per heat. The appropriation for this open-hearth plant, and also for other extensions to be made later at the Edgar Thomson steel works, was provided for early in 1912, and work on the erection of the plant was started in July last year, and the entire 14 furnaces have been completed and, at this writing, are ready for operation.

The Edgar Thomson steel works has some historical connections with it, the plant being located on the ground where General Braddock fought his last battle in 1575, and where, later, the insurgents of the Whiskey Rebellion assembled and took counsel before advancing on the city of Pittsburgh. Active work on the building of the Edgar Thomson works dates back as far as 1872, the first steel rail having been rolled on September 5, 1875. The plant has been constantly enlarged in the 38 years since the first rail was rolled, and at the present time the Edgar Thomson works has 11 blast furnaces, a Bessemer department with four 12-ton converters,

Tapping and Pouring Side of the Open-Hearth Furnaces

14 open-hearth furnaces, three rail mills, three foundries, a splice bar shop, a briquetting plant and auxiliary mills and shops.

Until the present open-hearth plant was built, the Edgar Thomson works has always made Bessemer steel, and the erection of an open-hearth steel works has really been under contemplation since 1895, and was made imperative by the steadily growing demand for open-hearth rails or for rails so low in phosphorus content that they could not readily be furnished in Bessemer steel. For some years it has been the practice of the Carnegie Steel Company to ship open-hearth ingots from the Homestead works to Edgar Thomson, re-heat them and then roll them into rails. This practice while fairly satisfactory was too expensive and was only carried on when it was not thought advisable to interfere with rolling schedules at the Ohio works of the Carnegie Steel Company at Youngstown, where open-hearth rails have been rolled for many years. It is the intention of the company to take out one of the present rail mills at Edgar Thomson and build a modern rail mill of larger capacity for heavy sections.



Valve Reversing Mechanism for the Regenerators

THE NEW OPEN-HEARTH FURNACES

The open-hearth furnaces are of the stationary type, and the plant includes gas producers, stock yard, skull cracker, cinder recovery yard, calcining plant and spiegel cupola plant. The furnaces are rated to produce approximately 90 to 100 tons per heat, and the output per month for the plant is put at 70,000 tons.

The open-hearth building is 150 ft. wide x 1230 ft. long, with a lean-to 41 ft. 6 in wide, extending the entire length of the main building on the north side. The pouring side of the plant is 64 ft. wide, and the charging side is 84 ft. wide. The charging floor is 17½ ft. above the general level, on which level is the floor on the pouring side. The charging floor being placed so much higher than the floor of the casting side has the advantage of doing away with pits on the casting side and also provides a cellar that is much cooler than that of the ordinary open-hearth plant.

The lean-to contains two narrow-gauge tracks, and the charging floor has one broad-gauge track running the entire length, and one narrow-gauge charging box car track. On the casting side there is one broad-gauge track for slag handling, and one 4-rail track for handling the spiegel. This 4-rail track consists of one broad-gauge and one narrow-gauge track on same line. The casting side also contains the narrow-gauge pouring track along the pouring platforms, together with the usual turn-outs. The casting side also is fitted up with four pouring platforms, each of which is capable of serving two heats. In the charging building there are three floor-type charging machines, built by the Morgan Engineering Company, and two 75-ton Alliance ladle cranes, each having an auxiliary hoist of 25-ton capacity. On the casting side there are three 175-ton Alliance ladle cranes, each having a 40-ton first auxiliary hoist, and 15-ton second auxiliary hoist. On the casting side also there is one 6-ton Whiting jib crane at each furnace for handling the pouring spout.

Each furnace has a hearth 15 ft. 3 in. x 39 ft. 6 in. The binding used is the Homestead type heavy slab, and the furnaces are all provided with Parks-Deuel removable ports. The raw materials for charging the furnaces are brought from the stock house, located on the north side of the furnace building. This stock house is 66 ft. 3 in. wide x 1036 ft. 6 in. long, and contains one broad-gauge and two narrow-gauge tracks. Four 15-ton Morgan cranes are provided in this building, two being equipped with magnets and two with Williams grab buckets. The magnet cranes are used for handling the metal and scrap, and the bucket cranes for handling the ore and stone from the Suppes stock pit. This plant will use a large percentage

The Slag Recovery Pit

of hot metal, and the metal is delivered over an elevated trestle from the blast furnaces to the mixer, and from the mixer to the charging floor in the 35-ton ladle, which is standard for the plant. This ladle is propelled by a Westinghouse electric locomotive.

The steel ladle has a capacity of 110 gross tons, and the slag pot, which is stationed alongside steel ladle, has a capacity of 315 cu. ft. These slag pots are handled to and from cinder recovery yard on standard slag pot cars similar to the ordinary blast furnace car, and are provided with an airpump mechanism. The re-carburizing of the rail steel is done by use of spiegel. This spiegel will be handled from the spiegel cupola plant in a 20-ton ladle on car, propelled by a narrow-gauge locomotive, and the ladle will be lifted by the first auxiliary hoist of the pouring crane and dumped into the steel ladle as the heat is being tapped.

The mixer building is located at the west end of the furnace building in line with the charging floor, and is 84 ft. wide x 120 ft. long, and its floor line is on a level with the charging floor. The building is arranged for two 500-ton metal mixers, one of which is already installed, while provision has been made for the other. The mixer body is of the barrel type, mounted on heavy cast-iron stands and rollers. The drive is effected by a screw through gearing from two 115 h.p. Westinghouse motors, and an idea of the mechanism may be gained from the accompanying illustration. In the mixer building there are three broad-gauge tracks, one of which is a continuation of the broad-gauge tracks from the charging floor. The other two are receiving tracks for hot metal from the blast furnaces. This building also contains a narrow-gauge tail track in line with the charging box car track in front of the furnaces. The mixer was designed by the Edgar Thomson works and built by the Pennsylvania Engineering Works of New Castle, Pa. The mixer building also contains one 75-ton Alliance ladle crane, with an auxiliary hoist of 25 tons capacity; this crane used for handling the 35-ton hot metal ladle and charging the mixer.

The Coal Hoist

The producer plant consists of 29 Hughes mechanical producers, five producers for furnaces Nos. 1 and 2, and six groups of four each for the remaining 12 furnaces, four producers for each pair of furnaces, with provision for a fifth producer in each battery. Each battery is located in a separate producer building 24 ft. wide and 87 ft. 6 in. long by 48 ft. high. A continuous walk connects all producer floors. The gas flues are all overhead, and are especially large. The Ahlen gas valve, 40-in. size, is used, together with a 40-in. air valve of the mushroom and damper type. Fourteen steel stacks, each 8 ft. in diameter and 180 ft. high, are located on the north side of the furnace building, and a specially large burn-out connection is provided between the gas flues and the producer stacks.

Stock House Showing Raw Materials

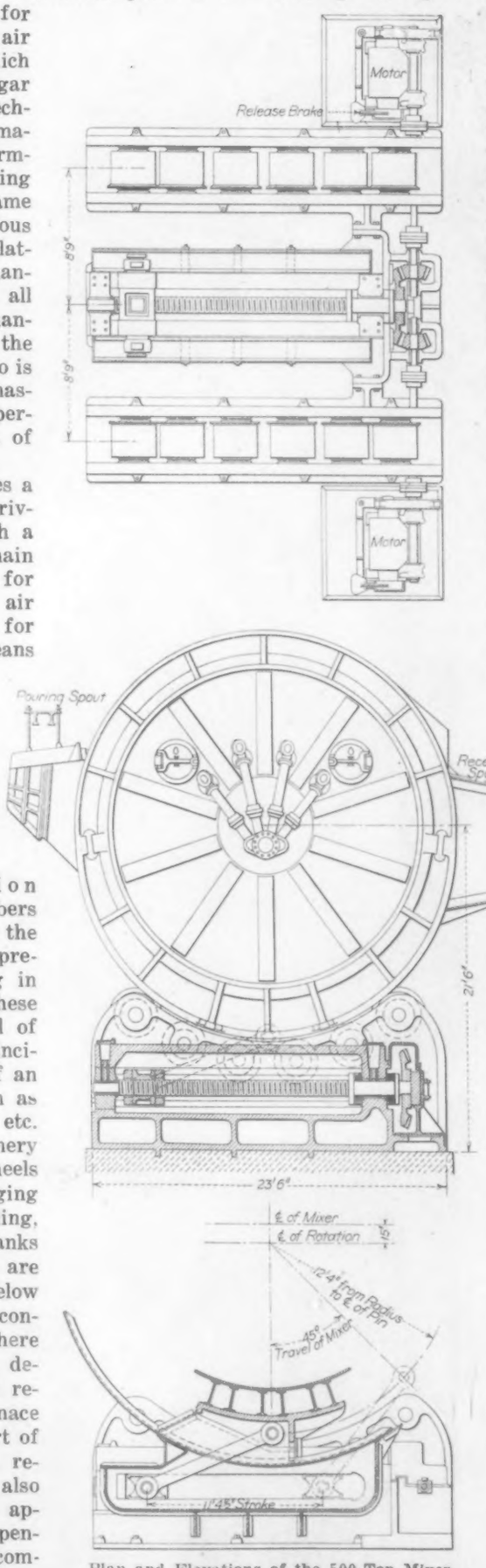
S. DIESCHER & SONS,
Mechanical and Civil Engineers,
PITTSBURGH, PA.

A DEVELOPMENT IN OPEN-HEARTH FURNACE REVERSING MECHANISM

One of the special features of the plant is the electric valve-operating rig for the gas combustion and air valves and dampers, which was designed by the Edgar Thomson works. This mechanism combines in one machine an apparatus performing the functions of reversing the furnace and at the same time adjusting the various valves and dampers regulating the furnace. The mechanism is arranged so that all valves and dampers are handled simultaneously under the control of the operator, who is required to move only a master controller in order to perform the whole operation of reversing the furnace.

The mechanism involves a 30-h.p. mill-type motor driving a main shaft through a worm and wheel. The main shaft consists of cranks for operating the gas and air valves, and has a sheave for operating the dampers. Means are also provided for adjusting the amount of opening of the different valves, varying from no stroke to full stroke, and it is by this means that the quantity of gas to the furnace is regulated, and the course of the products of combustion through the various chambers is controlled according to the requirements, thereby preventing excessive heating in any particular chamber. These adjustments allow for all of the setting of the valves incidental to the operation of an open-hearth furnace, such as warming up the furnace, etc.

The actuating machinery and the adjusting hand-wheels are located on the charging floor in the lean-to building, and the levers and bell cranks connecting to valves are mounted on a platform below the charging floor. In connection with this rig there is an electric recording device which indicates and records each time the furnace is reversed, and as no part of the mechanism can be reversed by itself without also reversing the complete apparatus, this gives the open-hearth superintendent a complete and exact check on the furnace operation. The mechanism has been in operation since the plant was started, and having been thoroughly tested out is giving the utmost satisfaction to the operators, who have continually had occasion to use the adjustments in connection with the operation of the plant, and who have found them of the greatest possible practical benefit in operating the furnaces.



Plan and Elevations of the 500-Ton Mixer

The coal and ash handling facilities for the gas producer plant are located between the fourth and fifth producer batteries, in a building 30 ft. wide by 76 ft. 6 in. long. The coal is brought in already crushed in broad gauge hopper cars and delivered to the track hoppers. From track hoppers it is delivered to a skip hoist, which in turn dumps the coal into the distributing bunker at top of the coal house. From this distributing bunker the coal is delivered to the various producer bunkers by means of an electrically operated larry car. The ashes from the producers are delivered by means of a larry car to a bunker alongside the skip pit. From this bunker they are chuted into a skip car and hoisted to the top and delivered by means of a chute to the ash bunker over a standard gauge track.

CINDER RECOVERY AND OTHER DEPARTMENTS

Slag is delivered to the cinder recovery yard in the slag pots and is dumped into a pit and crushed. The metal is recovered from the crushed slag by the use of a magnet, and the remainder is loaded into standard railroad cars for disposal. This cinder recovery yard is 85 ft. wide and 270 ft. long, and is swept by two Cleveland cranes, each having a 15-ton magnet hoist and a 15-ton grab bucket hoist. The yard is provided with two broad gauge tracks and two narrow gauge tracks. The ingot molds are also accommodated in this yard.

The spiegel cupola building is located on the south of the mixer building at the west end of the pouring building, and occupies a space 34 ft. x 82 ft. 6 in., with a hight of 74 ft. 3 in., and having a lean-to 19 ft. 9 in. x 33 ft. long. There are three 10 ft. 3 in. diameter cupolas for spiegel iron, arranged on a tapping floor 27 ft. 6 in. above ground level, with provision for one more. The supply is given, as in the coal house, by two skip cars on a double skip hoist. The capacity per cupola charge is 5 to 6 tons, giving a total rated output for 24 hr. of 600 tons. The top of the cupola shell is 97

ft. 3 in. above the yard level. The cupolas are tapped into a 150-ton mixer located on the north side of the cupola building. This 150-ton metal mixer is of special design. The shell body is 14 ft. 9 in. diameter and 20 ft. 10.5 in. over all. This mixer is electrically operated by two 75 h.p. Westinghouse motors, and was designed by Edgar Thomson works. On the pouring side of this mixer is a broad-gauge hot-metal track with a 40-ton scale located under the mixer spout, and one narrow-gauge track at the other end. The mixer proper is enclosed in brick walls to protect it from cupola dust. The special blowers and hoisting machinery are arranged in separate buildings. The blower house is adjoining the stock trestle, and the hoisting machinery is on a platform on two of the trestle bays, protected from dust by a steel frame construction, with corrugated iron sheeting.

The calcining plant is located on the north side of the stock house and is housed in a building 41 ft. 3 in. wide by 180 ft. long, with a lean-to 18 ft. wide, extending the entire length of the building, and another lean-to on the opposite side extending two bays. There are three 10 ft. diameter cupolas, and provision for two more. The raw material is brought from the yard on a track over trestles to the elevated broad-gauge track inside the building. It is dumped from the car into the bins, from which a 10-ton Morgan crane lifts it with a 2-ton bucket to the cupolas. There are two conveyors; one brings the material from the cupolas to the crushers and grinding pans, and the other conveys the calcined material to the storage bins.

The structural work for all buildings was furnished by the American Bridge Company and erected by the Edgar Thomson works. In line with the policy of the Carnegie Steel Company, every attention was given the matter of safety throughout the designing and erection of the plant. Each of the cranes handling hot metal is provided with inter-locking gearing and with a complete extra set of ropes. The steel ladle has especially large diameter trunions, which are located very high above the ladle's center of gravity. The mixer building and the pouring platforms in the casting building are all provided with refuge platforms. All of the narrow and standard gauge railroad equipment is provided with M. C. B. standard couplers. In addition, all buildings and flues are provided with platforms and stairways, making easily and safely accessible all equipment requiring attention.

Besides the reversing valve mechanism, which has already been mentioned, a special feature of this plant is the absence of hydraulic power. Metal mixers, furnace doors and various other machinery in which hydraulic power has commonly been used are here operated by electricity.

Probably the most striking feature of the plant is the few men that are required to operate it. Modern machinery has very largely replaced manual labor, and for a plant of this size and with its capacity for making steel a very much smaller force of men is employed than usual. Perhaps the most important feature, however, is the extraordinary care taken to insure safety of operation and safety to the men, as stated. All over the plant are signs printed in different languages warning the men of danger, and the list of accidents at the Edgar Thomson works, viewed from its immense size, are very few.

The first column of the open-hearth plant was erected on November 13, 1912, and the entire plant is now complete in every detail and has been making open-hearth steel for about six months. This will give an idea of the fast progress that was made in the building of the plant in which some records for quick construction were made.

Indianapolis Industrial Condition

From a statement issued by the Commercial Vehicle Protective Association, Indianapolis, Ind., the following extracts are taken:

The business interests of Indianapolis won a signal victory over the teamsters' union in the recent strike. But the most important result of the strike is the fact that the employers are welded together now, for defense purposes, and are determined to resist, to the last, further efforts to make Indianapolis a closed shop town.

The effort to unionize the teamsters followed the street car strike, and this movement was a part of a general programme of organized labor to make Indianapolis a closed shop town. The determined resistance on the part of the business men was evidently a surprise to the labor leaders, for the whole plan was soon abandoned by them. The teamsters were sent back to work on any terms that could be obtained, the demand for formal recognition of the union being entirely eliminated in the final instructions by the president of the teamsters' union to the strikers.

Through the initiative of the Employers' Association, practically all of the concerns in the city employing teamsters or drivers were brought together in an organization known as the Commercial Vehicle Protective Association. A campaign fund was raised and headquarters were established in the offices of the Employers' Association in the heart of the business district. An executive committee composed of leading manufacturers, jobbers and merchants directed the defense work. Special police powers were obtained for hundreds of loyal drivers. A force of 500 prominent citizens, including bankers, lawyers and business men was sworn in for special service, 100 of these being mounted.

On the first day of the strike no effort was made to move commercial vehicles. But the organization work was so complete that on the second day many trucks and drays delivered goods. Some of these were escorted by policemen, but in the main they were guarded only by private employees with police powers.

The result of this co-operative programme between the city officials and the business interests was that, within four days after the strike was declared, traffic had been restored to nearly a normal basis. The union had been able to enlist a comparatively small per cent. of the teamsters, and the great majority of firms were ready to operate with their regular drivers when protection was provided.

The business men say the strike has been worth all it cost because it has brought all the business interests to an appreciation of the necessity for co-operative effort. An enlarged and broader Employers' Association is being formulated and the fight for the maintenance of the open shop in Indianapolis will continue. Indianapolis has always borne the reputation of being an open shop town, and it is quite evident that the spirit of the citizens means that this condition shall not be changed.

The Mesta Machine Company, Pittsburgh, has received an order from the Cambria Steel Company, Johnstown, Pa., for a 600-ton steam hydraulic forging press to be used in forging axles. Many railroads are now specifying that their axles be worked under a forging press.

Labor Classified on a Skill-Wages Basis

A Plan for the Equitable Adjustment of Wages Inaugurated by the Ford Motor Company—Operators Automatically Rewarded for Increased Efficiency

BY O. J. ABELL

In the automobile industry at Detroit, the proportion of floating or transient help has been little short of amazing. The maintenance of a required force of men has necessitated in consequence a continuous hiring process involving numbers greatly in excess of the normal pay roll. One large manufacturer of automobiles found it necessary in 1912 to hire a total of 20,000 men in order to maintain an operating force of less than half that number. In the present year the situation has improved somewhat, but in the past this shifting about appears to have been quite independent of business conditions and no assurance is felt that a permanent stability is at hand. The expense created by this hiring of new men is enormous, the more oppressive because it is an unproductive outlay. Another builder of motor cars has estimated that the time required to hire a man and deliver him to the department in which he is to be employed is 2 hr. 10 min. On the basis of 30 cents an hour, this is an expenditure of 65 cents, or for the hiring of 5000 men a month—not an unusual experience—an expense of $3250, equivalent to a yearly cost of nearly $40,000.

The explanation for this instability of labor is in part obvious. The rapid growth of the automobile industry brought all classes of labor to Detroit from all parts of the country, both because of special inducements and in response to the natural appeal made by higher wage scales. Naturally the men most inclined to shift about were the ones who shifted to Detroit. Then, too, the seasonable variations in the operations of many of the plants contributed its influence to the general unrest, so that plants which have operated uniformly throughout the year fared no better than the others. Increases in wages which gave to the employee as much for 9 hr. as he could earn at other plants for 10 hr., plus his carfare and a little more, were equally unavailing. Plainly the opportunity for steady employment at good wages and under working conditions above the average in point of sanitation, safety and physical comfort was not in itself sufficient incentive for holding a job. And in this fact there is much to think about. It is a significant and interesting commentary upon the psychology of the average shop hand, a side light on the extension of welfare work in industry.

Table 1. Classification of Employees and Wage Schedule Made Effective October 1, 1913.

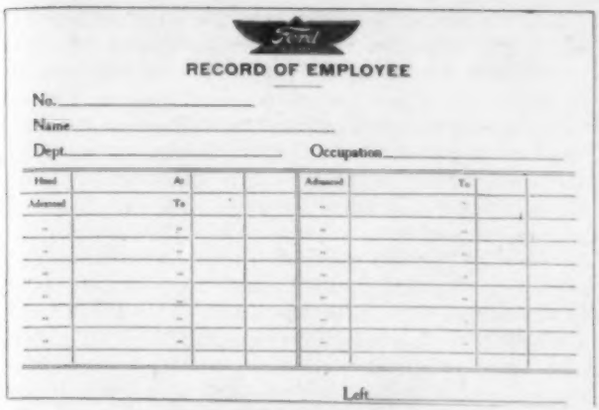
A—Mechanics and sub-foremen.
B—Skilled operators.
C—Operators.
D—Helpers.
E—Laborers.

Service—Employees in service continuously for two years and over.
1—First class workmen.
2—Men of average ability.
3—Beginners.

Skill Rate	Present Hiring Rate	New per Hour Rate	Rates Ranging	b-c	d-e	g-h	k-l	n-o	p-q	r-s	u-v	w-x	y-z
			Condensed to	a	c	f	i	m	n	p	t	u	w
A—xx				2	7								
A—x													
A—1		f				2							
A—2		i					45						
A—3		m						273					
B—Service		m						51					
B—1		n							606				
B—2		p								1457			
B—3	w	t									1317		
C—Service		n							19				
C—1		p								348			
C—2		t									2071		
C—3	w	u										4311	
D—1		p								31			
D—2		t									137		
D—3	w	u										416	
E	w	u										2003	
Special	y	w											208

Recognizing this much of the problem, the Ford Motor Company has undertaken to make continuous employment in its plant appeal to the men. (1) By satisfying each employee that he is being paid all to which his productive ability and period of service entitles him, both in dollars and cents and in comparison with the other men about him. (2) By making it possible for every employee to secure funds practically whenever he needs them without inconvenience and at a nominal charge. The first is to be accomplished by the classification of all employees under a fixed scale of wages according to productive ability and length of service, and the second, through the establishment of an Employees' Savings and Loan Association.

Both undertakings were placed in operation Oc-



Ford

RECORD OF EMPLOYEE

No._____

Name_____

Dept._____ Occupation_____

Hired	At			Advanced	To		
Advanced	To			"	"		
"	"			"	"		
"	"			"	"		
"	"			"	"		
"	"			"	"		
"	"			"	"		
"	"			"	"		

Left_____

Fig. 1—The Face of the 4 x 6-in. Manila Envelope for Keeping the Individual Employee's Record

tober 1. At the end of one month's trial a comparison was made with the month of December, 1912, a typical month under the former system. The facts developed are indicated as follows:

	December, 1912	October, 1913
Five-day men	3594	322
Men discharged	776	137
Men quitting	386	326
Men laid off	4822	844
Total hired	5678	1789
Gain for the month	856	945

In this statement the 5-day men constitute the typical floaters. Making full allowance for changed business conditions, this comparison still is most astonishing. While the showing of this one month is not considered as conclusive the coincidence is striking, the more so for the reason that the preceding months of 1913 were about the average months as represented by the December figures above.

The skill-wage classification was worked out from a general survey of the entire operating force. Direction was given to this survey by the following considerations:

1.—Justice as against discrimination for all employees.

2.—The reduction to a minimum number of all the different rates of wages paid.

3.—The establishment of a well regulated systematic schedule for increasing wages of individual employees by certain fixed amounts.

4.—The classifications of all employees according to their skill.

5.—A classification according to the term of service.

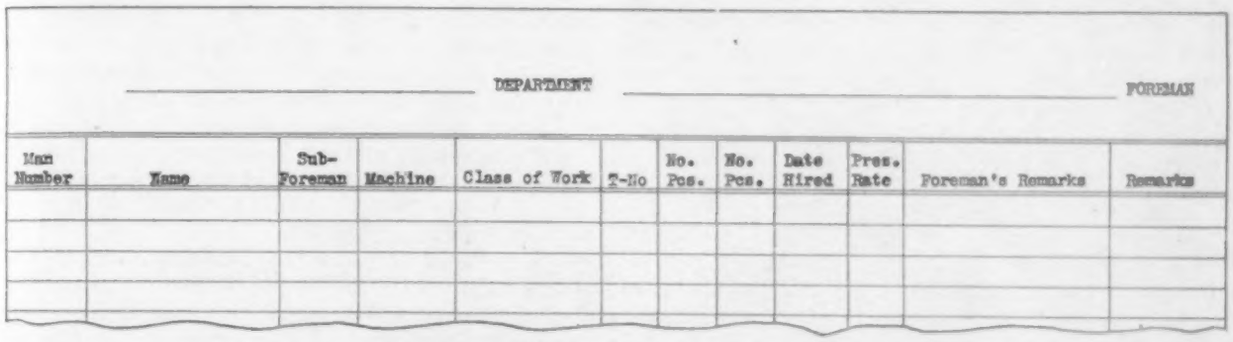
For a standard with which to compare the individual skill of each operator the established shop rate of the plant was taken. This shop rate for any particular operation is derived from the machine production as rated by the manufacturer less a percentage deduction for the human element and the necessary stoppages of the machine. For each operation in the shop the human equation has been based on the best possible production of a skilled employee determined by actual trial. Comparing the production of any employee, in making this survey, with the shop rate, it was possible to place his skill relatively in the scale. The observations made resulted in the establishment of six general classes or planes of work indicated alphabetically from A to E with one special class, as graphically shown in Table I.

Classification of Work

A—Mechanics and sub-foremen
B—Skilled operators
C—Operators, such as ordinary press hands, drill press operators, etc.
D—Helpers
E—Laborers and non-productive workers
Special—Girls and messengers

These several classes were then graded as regards skill into three subdivisions based on the shop rating.

1.—Meaning good.
2.—Meaning fair.



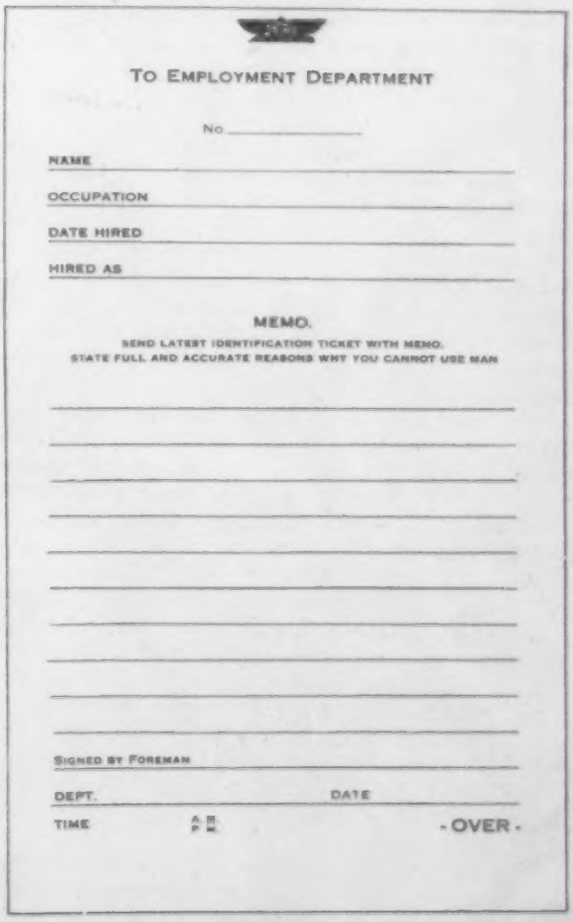
_____ DEPARTMENT _____ FOREMAN

Man Number	Name	Sub-Foreman	Machine	Class of Work	T-No	No. Pcs.	No. Pcs.	Date Hired	Pres. Rate	Foreman's Remarks	Remarks

Fig. 2—Blank for Recording Performance of Backward Operators

3.—Meaning medium and beginners.

Thus the designation C-2 indicates, for example, a machine operator of fair skill.



TO EMPLOYMENT DEPARTMENT

No._____

NAME _____

OCCUPATION _____

DATE HIRED _____

HIRED AS _____

MEMO.

SEND LATEST IDENTIFICATION TICKET WITH MEMO.
STATE FULL AND ACCURATE REASONS WHY YOU CANNOT USE MAN

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

SIGNED BY FOREMAN _____

DEPT. _____ DATE _____

TIME _____ A.M. P.M.

-OVER-

Fig. 3—Blank for Foreman's Report on the Inefficient Operator

Prior to the inauguration of this new system there were paid in the shop a large number of rates of wages varying from 22 cents per hour to 60 cents per hour. All of these rates were condensed into but 10, as indicated in Table I. As there were but nine employees earning above 50 cents an hour there are practically but eight rates now in operation. In adjusting the wages to the new system every employee was advanced. For example, in a group with wages included between the limits of 23 and 25 cents per hour, the 25-cent man receives 26 cents, up to which rate the 23-cent man is also brought.

Some complaint was made by the former employees, but it was demonstrated in practically every instance that within the narrow range of each of these wage subdivisions the men who were getting the smaller pay simply had been less fortunate in making their worth known or had been less favored by the foreman, and such pains were taken to demonstrate this fact to the men receiving the higher wage that no possible ground was left for complaint. The attitude of the company was also very clearly put before the men in that the company expected the operators to advance from one class to a higher and that if they did not inquiry would be made regarding the reasons therefor.

As applied to the beginners in particular the company anticipates that the employee should be entitled to an advance in the course of six weeks. To check this fact, the envelope in which the records of each employee are filed in the time-keeping department, are prepared with the form illustrated in Fig. 1, suitable for noting each wage advance that the employee receives. Pay-days occur every two weeks. If, after three consecutive pay days the envelope shows no record of an increase the envelope is laid aside and a report is made on the blank form shown in Fig. 2. The case is then taken up with the foreman of the department in which the man is employed and an actual record secured of his work. If he is entitled to an advance and has been overlooked the increase is given him.

It is impressed upon the foremen that their departments and their own showing are handicapped by the presence of men who cannot make the expected progress. The foreman knowing that the man already employed is likely to be as capable as the next average man to be hired thus has an incentive to help the employee as much as possible. If the workman shows himself unequal to the progress expected the foreman advises the employment department making out his report on the form shown in Fig. 3. This case is also investigated and it has been found frequently that an employee is better suited to work in another department, in which case he is transferred immediately.

A man is discharged only when it seems impossible to work him efficiently in any department of the shop, the general principle being that the man already hired about whom something is known is better material for further effort than the man who must be hired in his place and about whom nothing is known. It also frequently happens that a man when applying for a position overrates his own ability and it develops after he has been employed that he falls considerably behind the rate or class of work for which he is hired. This man is given the option of work he can do, at a lower wage, or of being discharged.

The plan contemplates the advance of employees from one grade of skill to a higher and also from one class of work to a more highly paid class. It is apparent, however, and is clearly shown in Table I that the majority of the employees are included in the B and C grades. It is obvious that the number of positions to be filled thus decreases very rapidly in the more skilled classes of work, and as a result more operators are likely to make progress entitling them to be advanced than there are vacancies available. In order to reward such operators an additional rating has been inserted into the C and B grades, known as a service rate. This is intended to provide for all operators who have attained a high grade of skill and who have been in the service of the company at least two years. This also affords a recognition for the faithfulness of those operators who have acquired proficiency in their particular work, but lack ability to advance to higher grades of usefulness.

Under this system the employee can be made to understand clearly that his own wages and those of every other man in the shop depend entirely upon the work he does, that an improvement in his work will be rewarded without fear or favor by a stipulated amount corresponding to the improvement shown and that increased production and a wider range of ability will bring about a definite advancement and a definite increase in earnings. The incentive to continuous service is equally clear.

The Savings and Loan Association, inaugurated simultaneously with the above plan, has some features different from those usually embodied in similar undertakings. The two objects of the association are stated as being the encouragement of the saving habit among the employees and the providing of a means by which employees may make small temporary loans with little expense and no loss of time. The association is governed without expense by an administration committee consisting of three men appointed by the vice-president or the treasurer of the Ford Motor Company and of such standing as to insure proper handling of the association's funds. Operating expenses are borne by the company. Membership is entirely voluntary and may be withdrawn at any time, the employee receiving a check for the full amount of his deposits. Each member is required to deposit with the association $1 each pay day, except where three pay days occur in one month, and in which case the third is omitted. The $1 is not taken out of the pay envelope by the paymaster, but is required to be deposited by the member with the individual in his department authorized to receive it. The earnings from the funds thus deposited will come from the fees made on loans to employees, from bank interest and from income resulting from investment and are to be distributed quarterly.

The loaning features of the association are perhaps the most interesting. Any employee of the Ford Motor Company, whether a member of the association or not—and it is interesting to note that most of the borrowers are not members of the association—may borrow from the association on the following terms:

$5 or less to next pay day	$0.10
$6 to $10 to next pay day	.20
$11 to $15 to next pay day	.30
$16 to $20 to next pay day	.40

A special "Loan Association" window has been set aside for the purpose, near the time clocks in the paymasters' shop office. These loans are secured by a receipt form signed by the applicant when he receives his money which form constitutes an order on the paymaster to deduct the amount of the loan from the next pay of the borrower. Loans may be applied for not oftener than once between pay days and cannot exceed $20, except by special arrangement with the administration committee. In the

evening when leaving the shop, the employee turns in at the association's window his time card with the notation on it of the amount he wishes to borrow.

From this notation and the time card, the time on the books to the man's credit can be located. If this covers the loan requested receipt form is made out for the employee to sign and the cash is handed over to him without question. He is required to identify himself by the display of his employee's badge which bears his clock and time card number and which all employees are required to wear in order to gain entrance to the plant each day.

This borrowing privilege is used freely and a long line of men avail themselves of it each night. The loaning does not involve the advancing of wages not yet earned, but confines the loans within the time already on the pay roll. An observation of the type of men generally making up the borrowing line seems to point clearly to the fact that these men are largely of the improvident and undependable type normally comprising the shifting class of labor. In their philosophy such an institution fits most conveniently. It is, therefore, reasonable to expect that this plan in operation will exercise some hold upon them. The period of operation has not yet been of sufficient length to indicate to what extent the same men repeatedly use this privilege, nor is it demonstrated to what extent this borrowing is occasioned by real need as against careless improvidence, although numerous instances have already come to light where misfortune has thus been greatly lightened. After an employee has made three loans he is questioned closely in order to discover whether the borrowing has a basis in real need or not, and investigations thus far have shown a preponderance of deserving cases. In some respects this plan which makes it so easy to secure money may have the appearance of catering to the undesirable element in the shop, but if it results in creating a habit of steady employment and continuous service, it may also develop other traits that naturally associate with steadiness in any direction.

The Heat-Treatment of Machine Materials

What the Up-to-date Manufacturer, Guaranteeing His Product, Has to Provide in Equipment, Methods and Organization

BY F. F. BEALL*

Guessing to-day is not listed among the business accomplishments. The manufacturer who guesses is not only a detriment to his own business but a potential source of danger to the public. The ultimate quality and dependability of any mechanical product are limited absolutely by the quality of its material. Whatever the type of machine, it can be no better than the metal of which its parts are built, and no amount of care or pains in workmanship afterward can insure strength or permanence for a structure whose foundation is the weak part.

In all lines of industry responsible manufacturers now guarantee certain results to the purchaser of their product. Their engineers in designing proportions and details, assume certain qualities of strength and durability in the material and figure certain factors of safety on these data to insure results for the owner. The purchasing agent in buying his material is careful to specify certain grades and analyses to conform to the design requirements. None of these provisions, however, can or does afford any positive assurance as to the actual quality of the stock received. It is important to recognize that up to this point the matter rests wholly on assumption as regards the essential properties of the material.

This imposes on the manufacturer the imperative necessity of knowing whether his material fulfills such requirements. Before incorporating it into his product he must be very certain not only that it possesses the particular properties essential to it as raw material, but also that it is susceptible of having such qualities enhanced by the proper treatment. Such conditions practically postulate, in standard manufacturing, the maintenance of an efficient laboratory and a highly standardized system of heat treatment. The results demanded cannot be secured with certainty in any other way and the neglect or omission of this feature must leave largely to guess work, the most essential element of the finished product—the material of which it is wrought.

Heat treatment, therefore, is so important in the vital character of its results and is necessarily of so complex a nature that this branch of the business should be very carefully planned and organized. The four chief essentials to be considered in securing the full measure of its advantages are:

1. An accurate knowledge of the qualities and composition of the material as received.
2. A complete and efficient installation of the heat measuring and recording apparatus, testing instruments, furnaces, etc., necessary to insure accurate and uniform results.
3. The best possible methods, based on experience, observation and progressive research, for handling materials and equipment.
4. An organization thoroughly trained to handle efficiently all branches of the work.

THE MANUFACTURING QUARANTINE STATION

The three requisites of equipment, methods and organization might be up to the highest standards of efficiency and yet count for nothing in the result if the first essential, knowledge of material, were lacking or incorrect.

Thoroughly equipped and efficient testing laboratories, both physical and chemical, must be maintained as the first essential and their reports used as the basis for accepting or rejecting all material purchased to specification. These departments may be considered by analogy as the manufacturing quarantine station, where every consignment should be detained under suspicion until it has shown a clean bill of health. This in effect insures a double check on every bar and billet received, as vendors

*Factory manager, Packard Motor Car Company, Detroit.

should be required to submit an analysis covering each heat from which the material supplied was taken, to be compared with the purchasing specifications.

The supervisor of materials, or whoever the executive in charge may be, must be held personally accountable for the observance of the standardized routine in handling material promptly as received. It is his duty to see that samples are properly selected and forwarded to the laboratories without delay, that the correct tests are duly made, the results checked against the standard specifications and the consignment either reported as unsatisfactory or immediately released.

Borings or chips should be taken from samples of carbon steel, while for alloy steels test pieces should be cut from different lengths and locations. Test bars should be cut from billets and forging stock and borings taken where this may be done without injury, the selections to be made at all times with the object of securing average specimens. Pig iron should be tested by analyses of borings taken from the outside and also from the centers of broken pigs. The foundry, also, should submit daily test bars cast from each heat of the various metals employed, in order that the quality of the castings may be held up to a constant standard. All these samples carefully marked and recorded for identification should be put through the regular physical tests for tensile strength, elastic limit, elongation and contraction, as well as careful quantitative analyses, to determine the exact actual proportions of the elements specified.

INSTRUMENT EQUIPMENT FOR HEAT TREATMENT

Heat treating as now developed constitutes an exact science. The extremely narrow range of the critical temperatures of many carbon and alloy steels demands so close a heat control and such accurate registration of instruments that only the best of equipment can be relied upon to fill the particularly exacting requirements of this work. Once the chemical composition of a steel has been determined and its classification established on that basis, the most vital point for heat treating purposes is its transformation, or recalescent temperature. This is best determined by the potentiometer, one of the most delicately sensitive and accurate instruments in industrial use for this purpose, as well as the most important safeguard available for heat measuring apparatus. By its use the possibility of the errors ordinarily involved in other methods of direct reading are practically eliminated. The principles of its operation embody the most scientifically correct method known for checking the accuracy of instruments of other types and it may also be used itself as a direct heat recorder, indicating in the hands of an expert operator, potential variations as close as 0.02 of a millivolt, a difference equivalent to about 2 deg. C. on the standard couple. With this instrument and a reflecting galvanometer properly adjusted, temperature determinations and transformation readings may be obtained of such accuracy that these data may be made the basis for plotting the exact curves of decalescence and recalescence of any piece of steel. The conditions thus indicated must be considered as final in regard to a given material inasmuch as they constitute the most absolute index known to science for its correct treatment.

There is a wide variety of pyrometers now on the market, some of doubtful value under any circumstances and a number of the highest efficiency under special conditions, such as those of college laboratories. Where the maintenance of high standards is insisted upon, these instruments must be of especially robust construction to withstand the severe conditions of factory use. Heat, if sufficiently intense, is the ultimate solvent of all matter, and no instrument of ordinary construction can long withstand the annihilating action if subjected to high temperatures day after day. For this reason the final selection must always involve the twofold requisite of the highest possible accuracy over the longest period of time, with the certainty that the latter is a compromise at best. Even the finest instruments that can be produced must sooner or later deteriorate. The only practical safeguard is to reserve under special care some instrument of established accuracy to be used as a check in calibrating those in constant service, and this instrument must itself be submitted at regular intervals to the Bureau of Standards at Washington for recalibration.

In addition to the indicating functions of the instruments above described, is the very important one of automatically and continuously recording the conditions shown. This feature, in fact, is absolutely essential to the maintenance of the greatest degree of efficiency. Without it those responsible have nothing whatever in the way of assurance that the methods specified in their instructions are regularly followed and errors or negligence on the part of the operator could continue unchecked until brought to light by damage already passed remedying. In addition to this, one operator, however capable or reliable, would find it impossible to note personally the essential data indicated by an installation of any magnitude and his necessary haste in attempting to do so would probably be one of the most productive sources of error.

The purely mechanical record, however, produced by properly designed and adjusted apparatus affords evidence of such certainty as scarcely to be questioned. This method keeps pace with the operation, affords a constant check for the observer as to its regularity, and gives a completed record with the finished work. One observer can easily regulate the operation of an extensive system and ensure immediate detection of any negligence on the part of the men or defect in the equipment. All the care exercised in providing such equipment, however, may go for naught if it is carelessly or improperly installed. The central recording and control station should not only be located within convenient observation of the department head's station, but it should also be so placed as to be absolutely immune from excessive external temperature reflections. Any serious variation in the surrounding temperature is almost certain to affect the adjustment of these instruments and introduce a wholly indeterminate factor of error. Every one of them is designed to work under certain conditions of temperature and these must be known and controlled if any dependence is desired for the results.

THE HEAT GENERATING INSTALLATION

Of equal importance with the heat-measuring and recording apparatus is the heat-generating installation. The general types are the gas, electric and oil furnaces, as well as ovens and baths of molten lead and the various mineral salts. The electric furnace, if development of this type continues as in the past, will undoubtedly prove in time an ideal form, but for general commercial purposes at present gas or oil is used to best advantage. Of these two, crude oil, with its comparatively low cost, convenience in storage and ease of control, with a simple air-pressure system, affords the most satisfaction for both economy and efficiency.

If the department is located within convenient

distance of a railway siding an underground storage tank into which oil may be run by gravity from tank cars and pumped the short distance into the furnaces gives an ideal arrangement. There are many features to be observed in the installation of an oil furnace system to secure maximum economy and heat efficiency. Possibly the first is its location, with regard to light, operation and convenience in handling the work. The independent burner type is essential for work of high quality in which close heat-control is necessary. Size is another important consideration and one which should be carefully studied beforehand in connection with the character of the work. In just the same degree that the carbonizing pots should conform closely to the parts treated to insure uniform heating and economy of carbonizing material, so the carbonizing furnace interiors should, so far as possible, represent multiples of the pot sizes to avoid waste of space, fuel and time. Methods of controlling and retaining the heat, after the furnace has been brought to the specified temperature, will figure largely in the fuel bill, and previous consideration of repairs and necessary re-lining can be made to reduce very materially this expense.

A very vital feature in the furnace design is the location of the "fire-end" of the pyrometer. It should be so placed that its readings will indicate the standard furnace temperature, and at the same time insure the instrument's safety from injury in handling the work. It should be noted here, too, that while the pyrometer records the actual temperature of the furnace, that this does not for an interval, at least, imply that the work has reached the same temperature. The men in charge of this operation can readily be trained, however, to recognize when the colors of the work and the furnace interior coincide, and this with the pyrometer reading, will ensure proper regulation.

A final consideration, and one often neglected, is the comfort of the operators. The work is necessarily, at all times, of a trying nature and in warm weather particularly so. The battery of large oil furnaces in the Packard works, extending the entire length of a 120 ft. room [shown in *The Iron Age*, June 5, 1913, page 1351] is curtained off straight up to ceiling with a sheet-metal partition, excluding in this way from the room the greater part of the heat radiated. A blower-system installed in conjunction with this not only draws away the heat, but also eliminates any injurious gases present. The opposite side of the room is entirely filled with windows and the floor area is practically clear, ensuring good light, convenience in working and the fullest possible air-circulation. The rooms are all floored with special paving brick, which is not only durable, but has the advantage of not heating up uncomfortably.

Typical Arrangement for Heat Treatment Work, Showing the Signal Lights on the Column and the Quenching Tanks Equipped with Ammonia Coils

Every furnace in the row is under the immediate control of the observer at the central recorder-board next to the office on the floor above [shown on page 1350, *The Iron Age*, June 5, 1913]. At brief and regular intervals each furnace in heat has its reading checked and any deviation from standard is at once detected. In this event the observer presses a button and throws a switch and on the floor below a bell rings and over that furnace flashes a white or red light as a signal to the tender to reduce or increase his heat. In this way the heat specified for the various parts are held steadily to standard, and the strict uniformity of results secured.

Just in front of the furnaces are the other necessary adjuncts of this work, the quenching tanks. These are sunk nearly to the level of the floor, are of ample size to afford sufficient cooling volume, and in addition to ensure the maintenance of low and constant temperatures have forced circulation con-

nections with a cold storage tank of 8000 gal. capacity in the basement. This is lined with ammonia coils charged by a regular refrigerating machine, with a capacity of 6 tons of ice per day. Special equipment of this nature is not only justified, but demanded by the fact that variations in cooling fluids may effect some of the more sensitive steels and alloys to the extent of 30 to 50 per cent in their physical properties. For those grades of steel for which water quenching is proper, the ordinary city water supply will usually be found sufficient, but the circulation feature should be emphasized for the reason above given.

THE EQUIPMENT FOR CASE HARDENING WORK

Where carbonizing work is done a selection of the proper carbonizing material is of the utmost importance. Upon the chemical analysis of the carbonizing material depends the nature of the case. Certain of the chemical constituents of steel, such as silicon and nickel repel the absorption of carbon. Steel can be carbonized in a way by soot from your smoke stack, but this would not give a case that would give the maximum amount of wear and the proper physical properties. There are many carbonizing materials upon the market; some of them of considerable merit, but before selecting the one to be used careful tests should be made both in laboratory and heat treating department.

In connection with this work carbonizing-pots and methods of handling must also be considered. The end of all pots must suffer destruction by the fire, so that durability is the final consideration. Hard cast iron, with its other advantages, probably offers the best solution for the problem. For handling this heavy class of work the men should be provided with the proper chargers, trucks, etc., and in addition all installations of any size should be equipped with an over-head truck and pneumatic hoist. One of the most common sources of waste in this work is in handling the compound. This item should be given special attention to see that proper facilities are provided to prevent scattering it about under-foot, and also to ensure that it is used to the full limit of its carbonizing capacity.

Supplementing the work of the larger furnaces in which the material, except during carbonizing operations, is exposed to the air, "lead pots" must be provided for heating all parts whose surfaces or finish would be injured through oxidation, if so exposed. These are simply smaller furnaces of the oil-fired type, containing pots of molten lead covered with charcoal to keep the lead clean and free from oxides, and maintained by pyrometer control at the temperatures specified for the different parts. Work immersed under these conditions is kept clean and is rapidly and uniformly heated to the exact temperature of the bath. Before reaching the lead pots, however, with their comparatively high temperatures, all work should be pre-heated to about 800 or 1000 deg. F. in an ordinary muffle type oil furnace. This greatly reduces the abrupt fluctuations in the temperature of the lead bath, with the consequent strains on heat-registering and recording apparatus. By keeping the pre-heating furnace well filled, production may also be materially increased, due to the shorter period required for the final heating.

The accurate temperature control of the lead bath is highly important, as this is used mainly for finished or nearly finished work, and for the most sensitive grades of material. Automatic recorders should register its temperature, minute by minute, and the observer should exercise special care to see that the signal for withdrawing the work is flashed at the proper time. Immediately alongside each heater should be located the proper quenching tank to reduce to the minimum the exposure of the heated part to the air. In the accompanying cut is seen one of the oil-fired furnaces with partially opened hood enclosing the lead bath. Adjacent to this are located the quenching tanks, one of oil and one of water. The cut also illustrates the method of handling clutch plates, showing the fixture used to prevent warping. On the post above are shown the colored bulbs for signalling temperature indications to the operator.

These, as well as all other quenching tanks in the department, have forced-circulation connections with either the main water supply or the refrigeration tank. An important feature of the quenching is that of keeping the part in motion until thoroughly cooled. Otherwise, in the case of oil, there is a tendency to surround the part with a stationary film of hot oil, and in water the danger of forming a steam envelope between the part itself and the rest of the fluid. In either event damage is almost sure to result, as there is an abrupt cooling and hardening of the surface layer at the first contact before the heated interior has had time to contract. As the water or oil in contact with the surface becomes hot, this layer is weakened by the reheating from the core and develops cracks under the strain.

HEAT-TREATMENT PLANT AVAILABLE FOR FACTORY TOOLS

In caring for factory tools, an efficient heat-treating department affords a great advantage. With the old method, under which the blacksmith or tool-maker did his own tempering and hardening, according to general tradition and his personal judgment, results were as varied and uncertain as the abilities of the men and their means of handling the work. With standardized methods and accurate equipment, all such guess-work may be eliminated and a product turned out whose results are practically a routine certainty.

In addition to the items already enumerated, a well-equipped heat-treating department should be provided with various other facilities, according to the nature of its work, such as special testing apparatus for inspection, verifying results, etc. In hardness testing the standard should be first established by the Brinell testing machine and the parts then checked to this by the scleroscope. All pieces should be given a surface hardness test and in special cases a shock test as well. For smaller case-hardened pieces, samples may be selected and broken, the amount of pressure required and the depth of the case affording the necessary indications of quality.

METHODS IN HEAT TREATING

Method in manufacturing is the measure of the management's ability to get the most possible out of material, equipment and organization. This in heat treatment represents the maximum of certainty and uniformity in process—and strength and durability in results. Such conditions involve, first, the establishment of correct standards for the finished product; second, the determination of the processes which will most efficiently and economically ensure the result, and, finally, the assurance that the instructions covering the details of the work are fully and regularly enforced.

Since results alone are the final index, every step in the handling of a part must be based on

demonstrable facts. Opinions don't count. Before a process is established, or before a change is made, all the facts and evidence should be determined, and the relation of cause and effect clearly proved. Omitting technical details, the result ultimately sought from heat treatment is a substantial increase in the strength and toughness of the treated material over that shown in its natural state. Once assured of the proper analytical conditions, certain definite principles must then be followed in the development of the correct method.

Forgings, for instance, as ordinarily delivered, have a core in which the crystalline structure is more or less coarse, due to slow cooling from a temperature in excess of their transformation temperature. This, if uncorrected, might result in breakage under comparatively light strain, because of the well defined lines of cleavage already existing between the crystals. The loosely granular structure of brittle cementite and soft ferrite crystals must be replaced by the uniform texture of a fine martensitic structure which affords the ideal condition of hardness and ductility. This necessitates reheating until the critical point is reached and the excess carbide has passed into solution with the resultant change in texture and strength. The structure must then be locked in that condition by quenching the metal so suddenly that retransformation cannot occur. The degree of hardness resulting should be controlled according to circumstances by the temperature and nature of the quenching bath. If ease of machining is not essential the quenching operation may be varied to secure the maximum of hardness possible for that analysis. If special toughness is desired this may be secured by drawing the metal in the proper bath at the temperature standardized for that grade. Any drawing medium with a fixed fusion point, such as saltpetre, is inferior in this respect to a good drawing oil, because of the greater flexibility of the latter in conforming to a special temperature needed.

METHODS IN CASE CARBONIZING

Case-carbonized steels must be considered, in a sense, as dual-nature metals, because of the variation in the proportions of the controlling factor—carbon, in case and core. Research has shown that after a moderate penetration of carbon-case is secured, the strength of material varies in inverse proportion to the ratio of this case to the remaining area. This establishes the principle that mere thickness of case is no merit, but that the ideal condition is a uniform layer of no more than the depth necessary for the service required.

Under methods of carbonizing, the two factors of time and temperature should be emphasized. The extent of the process may be varied within certain limits almost directly as either factor is increased or diminished, but uniform results cannot be secured from an attempt to short-cut the process. The increased rate of amount of penetration secured by raising the temperature soon involves a sacrifice of other conditions more vital. The variation of carbon content in core and case further involves two transformation points, that for the low carbon interior being the higher. Correct practice consequently requires two treatments, one to refine and strengthen the core, and, since this has overheated the case, a secondary treatment at a lower temperature to restore the case to its maximum of strength and hardness. Extreme hardness may be modified and toughness increased by the same methods as before described.

Heat treatment in the form of annealing, for both forgings and castings, is another feature which is productive of much or little advantage according to the accuracy with which it is handled. To secure the full benefit of this process the highest temperature consistent with results should be used. This emphasizes the importance of knowing for this work exactly the temperature applied, and consequently the advantage of performing it under correct conditions as regards the equipment and methods.

The general question of methods under this subject is one that should receive the special consideration of the management, as no one of the mechanical arts has advanced so rapidly or proved its value so conclusively in recent years. Those responsible for this work must not only keep in touch with the best practice and progress of others, but must continually strive for increased efficiency and economy in their own organization. The continuous advance in metallurgy particularly in the development of the alloy steels, makes necessary a corresponding progressiveness in heat-treating practice everywhere. Present day methods produce results revolutionary in comparison with those of only a few years past, and the science is far from being a completed one to-day.

ORGANIZATION, THE FOURTH ESSENTIAL

The ultimate factor in any complex mechanical result must always be the human element. All the previous effort in securing the best materials, the finest equipment and planning the most efficient methods is finally dependent on the intelligence and reliability of the organization to whom the execution of the work is entrusted and if this is supplemented by careful and constant supervision the most exacting results will be obtained.

British Iron and Steel Exports and Imports

The exports of British iron and steel for the first 11 months of this year show an increase over those for the same period in 1912. The total sent abroad to December 1, 1913, excluding iron ore and including scrap, was 4,,677,565 gross tons, as against 4,548,471 tons to December 1, 1912, or an increase of 129,094 tons. In value the increase is £5,942,660, the total exports to December 1, 1913, being valued at £50,581,710 as compared with £44,639,050 to December 1, 1912. Pig iron exports continue to show a decrease, the total, including ferroalloys, being 1,050,682 gross tons to December 1, 1913, as against 1,180,900 tons for the same period of 1912. Of galvanized sheets the exports were 700,540 tons to December 1, 1913, as compared with 598,768 tons to December 1, 1912, an increase of 101,772 tons.

Iron and steel imports, excluding iron ore and including scrap, for the first 11 months of 1913, show an increase of 242,631 gross tons, totaling 2,110,772 tons to December 1, 1913, as compared with 1,868,141 tons for the same period in 1912. The values for these two periods are £14,122,238 and £11,881,314 respectively. Imports of finished materials continue the tendency to displace semi-finished steel. While the imports of blooms, billets and sheet bars for the first 11 months of 1913 amount to 737,000 tons as against 768,000 tons to December 1, 1912, the imports of plates to December 1, 1913, have increased nearly 60,000 tons and of angles and shapes, excluding joists, 47,000 tons over the same period in 1912.

The Mahoning County Light Company, Youngstown, Ohio, is planning the erection of a large power plant.

Chile As a Factor in Panama Canal Trade

Nitrate Shipments to Be Reinforced by Iron Ore and Copper—A Good Outlook for Return Cargoes From the United States

BY CHARLES M. PEPPER

In this article, which is the third he has contributed to "The Iron Age" since he started on his South American tour, Mr. Pepper discusses commercial and industrial conditions in Chile from the standpoint of the new relation of that country to the United States due to the Panama Canal. The attempt to establish an iron industry is interestingly told, and Chile's large and not entirely safe dependence upon her nitrate deposits is brought out. Financial conditions are not what they should be. The policy of the Steel Corporation in building up trade with Chile is held up as a pattern for other manufacturers and the prospects for an increased trade between this country and Chile are considered good. Mr. Pepper's South American trip follows eight years of service at Washington as foreign trade expert of the State Department.—THE EDITOR.

VALPARAISO, CHILE, December 10, 1913.

A Chilean Mountain Road

CHILE for many years has had a policy of developing her natural resources. One feature of this policy has been the encouragement of native industries. Most Americans will be apt to sympathize with it, though some of its manifestations may not seem based on sound economic principles.

The mineral resources of Chile are first, and above all, the saltpetre beds, the nitrate of soda fertilizers, in the north. With these it has been simply a question of the government exercising a general supervision over the industry and getting the largest possible revenue from the auction sale from time to time of the nitrate beds and from the export tax. The other mineral resources are iron ore, coal, copper and some silver. The main hope of national industries centers on the deposits of iron ore and coal. Coal beds along the coast, and especially at Coronel and Lota, to the south of Valparaiso, have been worked for many years. The deposit is chiefly lignite and has not avoided the necessity of very large importations of a better quality of coal from Australia and Wales.

A NATIVE IRON INDUSTRY

The existence of the iron ore deposits in the north has long been known and their quality and extent fairly well determined. But they never have been exploited appreciably either for domestic industries or for export. Ten years ago, however, a determined effort was made to establish a native iron and steel industry. While there was no coal of the kind that would serve, there were vast timber districts in the south of Chile from which it was assumed ample charcoal could be obtained. Corral, as most convenient to the timber region, was selected for the experiment. With the backing of the Chilean Government a French syndicate was formed to take hold of the project. Just how far the Creusot Works in France were interested in the enterprise is a matter of doubt, but their name has been freely used by the Paris bankers who financed the scheme. Assembling the raw materials presented some difficulties, since the iron ore and the limestone were in the Coquimbo district, 200 miles north of Valparaiso, and the timber regions from which the fuel was to be drawn were 500 to 800 miles to the south. It was calculated nevertheless that water transportation of the ore and the limestone would not form a heavy item of expense.

I was in Chile at the time the preliminary investigations were made and have a lively recollection of the enthusiasm with which the proposition was hailed. The Chilean Government provided a liberal financial guarantee and in other ways lent its aid. The plant was established as planned, at Corral; one blast furnace was for a time in operation and some pig iron was produced. This was about as far as the actual manufacture of iron and steel went, although there were great expectations of the open-hearth furnace as the medium for a complete plant which would supply merchant steel and rails. The terms of the concession required the production of 7500 tons of pig iron annually.

PIG-IRON MAKING STOPPED

Operation of the plant was intermittent and for more than a year past the single blast furnace has

The Copper Smelter and Pier at Lota

been inactive. It was stated that one cause of trouble was the failure of the timber regions to come up to expectations as sources of supply for fuel. Extensive grants were made by the government to the company, but it was found that on much of the area there were settlers who had something more than squatters' rights and they could not be ousted. Other difficulties related to the shipping facilities and to the financial management generally. Some skilled labor was brought from abroad in the beginning of the enterprise, but the main dependence had to be on the native labor, and this was found to be lacking in many respects.

In spite of all these obstacles Chilean public sentiment has been pronounced in favor of the policy of a native iron and steel industry. There has been much criticism in the newspapers, both of the government and of the company, for cessation of work at the Corral plant. Possibly as a result of this criticism it has been given out that plans of reorganization are well advanced, that a large stock of "seasoned" timber has been accumulated, and that the blast furnace will again be put in operation and other furnaces also started with a view to securing ultimately a steel rail mill which will supply the Chilean railroads with all the rails that they will need. It is reported that in the plans for reorganization the requirement as to 7500 tons of pig per year has been reduced to 6000 tons. On that basis the output of steel rails can hardly be extensive.

DISPUTED OWNERSHIP OF IRON ORE

One hindrance to the future of the industry has been cleared away, it is declared, by the ending of a controversy as to the actual ownership of the large area of iron ore deposits in the Albarrobo district adjacent to Coquimbo. Some officials of the French company had entered into negotiations with a Dutch-Westphalian syndicate for the sale of these deposits. The company, however, objected to its consummation and appealed to the Chilean courts. The local courts decided against it, but the superior tribunal revoked this decision. This is said to be of great importance to the country, since the French company had made what amounted to an assignment of the deposits it held to the Chilean Government under certain conditions. One condition was that the ore should be utilized at the Corral plant. The litigation as to the Algarrobo fields is not finally concluded, but it is assumed that the decision of the superior court will stand.

While there is a strong public demand for the utilization of a portion of the iron ore in Chile in the manner indicated above, and while ultimately the national industry may be established on a firm basis, there are many intervening difficulties, especially as to the production of iron and steel in Chile on an economic basis. The shipping facalities at Coquimbo for the ore are not of the best and Corral is also lacking in facilities for handling cargo. These, however, are incidental questions and not insuperable obstacles. But it cannot be said that Chile's importation of iron and steel is likely to be lessened by the establishment of a native plant, for many years, if ever.

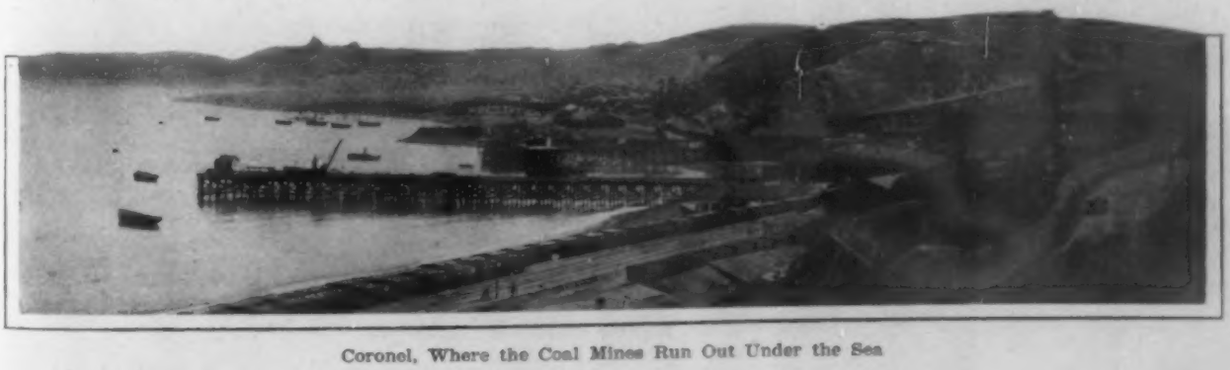
Another project in reference to the Coquimbo deposits in which it is claimed French capitalists are also interested, is the establishment of blast furnaces in the north, close to the mining district. The plan is reported to be based on the importation of coke in sufficient quantities through the Panama Canal, the assumption being that the reduction in freight will be sufficient to justify depending on it for fuel. In the meantime the Bethlehem Steel Company's plans for Tofo go steadily forward, and by the time the new 15,000-ton cargo steamers are completed Mr. Schwab's company is expected to have ample ore ready for transportation.

THE COPPER INDUSTRY

While it will be a year or more before the iron ore shipments from Chile will add materially to the volume of its exports, other mineral exports are already increasing. At one time Chile exported some 30,000 tons of copper annually, a large portion of which came from Lota and Coronel, where somewhat primitive smelting methods were employed and where the coal mine which is the source of fuel supply runs out under the sea. Within the last two or three years the northern districts have been worked more systematically and it is their production that promises to restore Chile to its former position. The copper exports are now about 18,000 tons yearly. The Guggenheim interests, which are operating the Braden mines near Santiago, and by modern processes getting the best results from the low-grade ores, are shipping the pig copper through Valparaiso to Europe.

Mejillones, north of Antofagasta, promises to rival that port in its copper exports when the Chile Exploration Company, which is another name for the Guggenheims, gets its plans for that region in full operation. Mejillones has a fine natural harbor, while Antofagasta is anything but a good harbor. The original purpose was to create a new port which would have been more convenient and less expensive for these shipments, but the Chilean Government, while not illiberal toward new development enterprises, did not favor the idea for political reasons.

It has been something of a revelation, not only to the native concerns but to the Europeans as well, to observe the attention given to transportation by American companies which have come into Chile during the last year or two. All they seemed to seek was a good cove somewhere along the coast, with an air line gravity railroad to bring the ore down to be smelted. But the existing ports began to raise objections that they would be ruined, and the Chilean Government heeded these protests. Yet generally the American companies have been able to get their transportation facilities both from the miner and at the ports down to an economic basis.



Coronel, Where the Coal Mines Run Out Under the Sea

THE FUTURE OF NITRATE EXPORTS

The possibility of the nitrate deposits becoming less valuable as sources of national revenue is always before the Chilean Government, and that is one reason why it is disposed to encourage the exportation of iron ore and copper; but it cannot go too far against the existing ports, which want their share of the exports. It will be a good thing for Chile when she is able to place less dependence on the fertilizers, although these comprise the basis of her extensive foreign commerce and furnish the bulk of the $125,000,000 the country pays annually for imported goods. The purchasing power is an enormous factor in the foreign commerce, but the nitrates are deprecated by many Chileans as undermining the country through their borrowing power. There is no question as to the extent to which they have caused national extravagance and have encouraged foreign loans that the country could have got along without. Yet they are of exceeding importance in maintaining Chile's credit, for she scrupulously meets all her foreign obligations.

Nitrates as a source of revenue to the government also justify the liberal expenditures for public improvements that have been incurred. The most important of these now under way is Valparaiso harbor. This is of special consequence to foreign manufacturers and exporters, because while Chile's exports are distributed through a score of ports, the bulk of the imported merchandise comes through Valparaiso. The contracts for the new breakwater and the other improvements which are now under way involve the expenditure of $12,000,000. Europeans secured this contract and much of the material will be bought in Europe, yet the United States will not be entirely ignored in the purchases.

The Chilean Government is a heavy buyer, but military armament makes up a large part of its purchases. Besides the naval vessels the country bristles with fortifications from Arica in the north to Valdivia in the south. Coast defense for a country with a coast line of above 2500 miles means something. The government is also a heavy buyer of railroad material, since it owns and operates practically all the railroads outside the nitrate districts. The operation of these roads in Chile is a striking object lesson against state ownership, but not against the government as a purchaser of rolling stock and rails.

COMMERCE WITH THE UNITED STATES

Commerce of the United States with Chile is fairly satisfactory. It ranges in the neighborhood of $40,000,000, with the balance easily in favor of Chile on account of the American purchases of nitrate and copper. In 1912 the imports from the United States were valued at $12,000,000. Iron and steel, machinery and the like furnish the most important items.

American business interests seem to be established on a solid basis after many years of uncertainty. When they first began to seek trade in Chile the Americans were slow to understand the importance of having their goods in stock where they could be seen and supplied. All the great importing firms had extensive warehouses, but the delusion continued in the United States that this was not necessary; that descriptive catalogues and an occasional sample would be sufficient. The United States Steel Corporation in the systematic expansion of its foreign trade was among the first to grasp the situation. It established its own warehouses and then business began to flow in. Other American concerns were not in a position to do this on the same scale, but they also realized that they must have a stock available, and now most of the big importing houses carry large quantities of American goods which are available for customers.

UNSATISFACTORY CURRENCY AND FINANCE

One unsatisfactory thing about doing business with Chile is the financial system. With abundant natural resources, and with equally abundant national revenues, the country permits a fluctuating currency system to continue to the great demoralization of its trade and industry. The Chilean peso, or dollar, the nominal value of which is 18d. (36 cents) and the actual value of which was at one time the same, to-day fluctuates around 9d., or 18 cents. The laboring classes are the worst sufferers, but all business suffers except that of the speculators in exchange and money brokers.

Chile has on deposit in Europe an ample supply of gold as a conversion fund—$36,000,000—and could put its currency on a sound basis if it simply

A Section of the Hillside Residences, Valparaiso

Spanish Fort at Corral, the Location of Chile's Modern Iron and Steel Industry

decided that this should be done. But some powerful interests, land owners, speculators and politicians, do not want it done, while others are divided in their opinion as to the proper method.

To an outsider it looks as though the solution was the one proposed in the United States at the time when numerous plans were discussed for resuming specie payments, and some one in high authority said that the way to resume was to resume; and the United States did resume. Whenever her finances shall be established on a firm foundation and kept there, Chile's position in South American commerce will be immensely strengthened. Until then there will be uncertainty and ever impending financial panic, worse perhaps than actual panic.

No panic exists at present and the situation is more accurately described as a monetary crisis. The newspapers are filled with the discussion and the Chilean Congress which is in session and with which the remedy lies, is appealed to sometimes by the way of suggestion and sometimes threateningly. The situation is much like that in the United States when the Aldrich Monetary Commission began its labors and everybody could point out the defects of our banking system, but no two authorities on the subject apparently could agree on the proper way to cure the defects. In Chile, however, there are the actual disturbance of business, the dislocation of credits and the suffering of the laboring classes who find the paper dollar in which their wages are paid buying less and less of the necessities of life.

A GREAT VOLUME OF IRREDEEMABLE PAPER MONEY

There is $150,000,000 of this irredeemable paper money outstanding. It is called irredeemable notwithstanding that a law of conversion is declared by some Chilean publicists to be in force. The different denominations of the paper bills say, "Convertible into gold by the State in conformity with the law," but they do not specify what law, and from this arises the character given them of irredeemable notes. But whether as they circulate to-day they are irredeemable or not, the Chilean Government through the congress has the power to make them redeemable, and also has the resources to redeem them. Last year more than 2,500,000 tons of the nitrates and their by-products were exported and the export tax collected by the Chilean Government was above $30,000,000. Not all of this is needed to pay interest on the foreign debt and to build dreadnoughts and expand the military equipment.

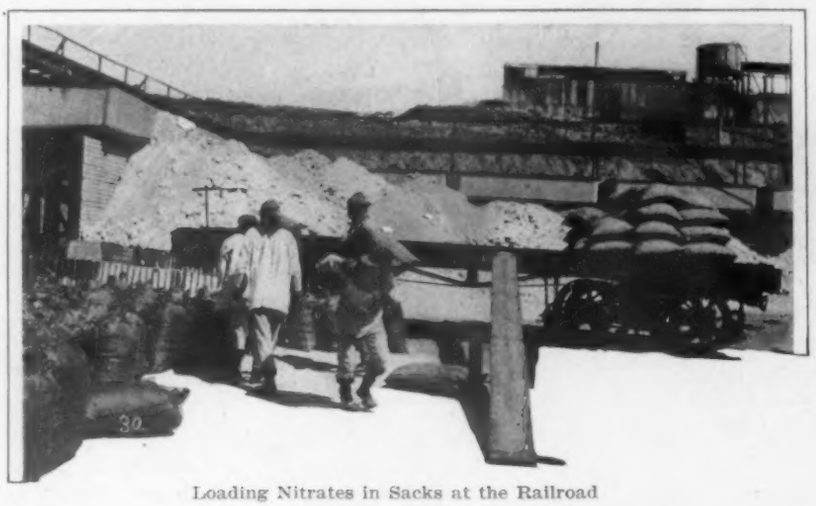
Usually Chile has managed to meet emergencies of all kinds, both political and financial ones. Notwithstanding that the present situation is so serious, because it is so essentially an economic crisis, a remedy which will be something more than a temporary palliative will be found, though perhaps not until after further shock to the business community of the country and to the government itself. Whatever happens, the foreign credit of the country will be maintained and national policies which relate to keeping Chile to the front in world commerce will not be abandoned, though some of them may suffer a temporary check owing to the lack of available resources to carry them to a conclusion.

CHILE AND THE PANAMA CANAL

In everything relating to the advantages to be secured from the opening of the Panama Canal Chile may be depended on to find the necessary resources. The provision made for improving Valparaiso harbor is a case in point, although these improvements were not undertaken solely with reference to the canal. But Chile proposes to facilitate intercourse with the United States through the canal and if possible to provide direct steamship communication with the Atlantic coast. The Chilean steamship line known as the South American Steamship Company, which runs between Valparaiso and Panama, and which is in the pool with the Pacific Steamship Company, now owned by the Royal Mail, receives a mail subsidy from the Chilean Government, and one proposition was that it should extend its service through the canal. A broader project was investigated by a special commission. This was the establishment of a line through the canal to New York and Liverpool, but with special reference to the United States. This enterprise would require a direct government subvention. Congress has not acted on the commission's report, but the project is not dead and in some form it is likely to be carried out. The appeal to national sentiment is made in the requirement that the vessels shall be part of the Chilean naval reserve and be at the disposal of the government in the event of war. It is also worthy of remark that while Chilean national policy looks

to building up a merchant marine, it is not assumed that private enterprise alone can bring this about, but that government aid is both desirable and justifiable. A line to Trieste, jointly Austrian and Chilean, receives state support.

While Valparaiso is at the extreme end of the section of South America which comes within the direct traffic radius of the canal and while the Straits of Magellan for geographical reasons always will have a good share of the carrying trade, it must not be overlooked that the Chilean coast extends to Arica, nearly 1,000 miles to the north, and that much of the commerce is through these northern ports. Moreover, they are the ports from which are shipped the nitrates and from which will be shipped the copper and iron ore resulting from the Schwab and the Guggenheim investments. This means that there will be ample return cargo facilities for merchandise from the United States and especially for the machinery and other manufactures of iron and steel that go with mineral development.



Loading Nitrates in Sacks at the Railroad

Taking the country as a whole and assuming that the financial confusion will be straightened out, as it will be ultimately, Chilean trade offers permanently favorable opportunities to manufacturers in the United States. They should early be investigated.

Corrosion of Steel and Its Correction

The following extracts are taken from a paper read at the College of Applied Science, Syracuse University, Syracuse, N. Y., December 17, by J. T. Hay, chief metallurgist and chemist of the Stark Rolling Mill Company, Canton, Ohio:

Corrosion, or the rapid rusting of iron and steel may be considered as an effect of the combined action of water and oxygen or in a broad sense, of moisture and air. Both air and water may contain elements which will stimulate or accelerate the corrosion. The most widely accepted theory of the cause of this rapid rusting or corrosion, called the electrolytic, is based on the fact that when two substances having different electrical potentials are immersed in a suitable electrolyte, an electric current is set up and corrosion begins at once. In iron or steel the various impurities differ from the element iron in their electrical potentiality, and the moisture in the air contributes the electrolyte. It is also true that this action is of a chemical nature and that because of the very close connection between electrical and chemical action we are able to control this chemical action by stopping or accelerating the electrical action.

Numerous investigators have been working for years along these lines and they have proved many facts heretofore in doubt to the great benefit of the iron and steel consumer. The purity of iron has a marked influence on the rapidity of corrosion. The quantity of the impurities must not only be very minute, but those few elements which it is impossible to remove entirely must be absolutely homogenously distributed.

Iron is more sensitive and has the power of varying its crystallization or form of structure in a greater degree than any other metal, and the manufacturers have learned that the whole art of producing corrosion-resistant metal consists in freeing it of its impurities and producing the type of crystallization desired. Our constantly advancing knowledge of heat treatment and increased skill in the use of the pyrometer are making it possible to produce these quality products more and more uniform. Because of the extreme sensitivity of iron, great care must be used in its physical treatment or the work of having eliminated the impurities will be labor lost. The strains produced in rolling, unless removed by careful annealing, will generate active corrosion. These strains are caused by excessive speed in rolling or by extreme pressure on the material in breaking down.

Service Test of Copper-Bearing Sheets

Results are published of a service test of sheets made by the G. Drouvé Company, Bridgeport, Conn. The company states that in the autumn of 1912 it conducted an acid test of various rust-resisting sheets, and later made a comparative service test which was concluded in October, 1913, and which made a similar showing. Three trays or pans of uncoated black sheets were placed on the roof of a building on November 5, 1912, and were taken off the roof October 9, 1913. The losses by corrosion are indicated in the figures below:

	Material A	Material B	Material C
November 5, 1912	54½ oz.	63 oz.	61 oz.
October 9, 1913.	36 oz.	36 1/3 oz.	32 oz.
Loss	18½ oz.	26 2/3 oz.	29 oz.
Percentage loss.	34 per cent.	42 3/10 per cent.	47½ per cent.

Pan A was made of copper-bearing sheet steel, while pans B and C were of steels made in the open-hearth furnace by processes aiming at a minute content of impurities. The analyses of the three steels are given in the following table:

	A	B	C
Carbon	0.13	0.025	0.025 per cent.
Manganese	0.40	0.038	Trace per cent.
Sulphur	0.027	0.030	0.029 per cent.
Phosphorus	0.004	0.005	0.004 per cent.
Silicon	Trace	Trace	Trace per cent.
Copper	0.29	0.17	0.04 per cent.

The time within which the American Can Company and other defendants were required to file answer to the Government's anti-trust suit entered at Baltimore, Md., November 20 last for the dissolution of the company, has been extended until January 31.

Plant of the Hart Mfg. Company, Cleveland

New Factory for Making Die Stocks—Features of the Equipment of Wide Application —Departmentizing of the Machine Shop

The new factory recently erected and now occupied by the Hart Mfg. Company, Cleveland, Ohio, is of more than ordinary interest because the building represents the latest improved methods of factory construction and much study was given the subject of arrangement for convenience in routing and handling material in the process of manufacturing to insure economy in operation and production. The products of the plant are die stocks, both for pipe and bolts. Departing from the usual practice of the makers of die stocks this company has equipped its new plant for all the manufacturing and finishing processes required with the exception of making the rough castings, these processes including in addition to machine work, enameling, nickel plating, polishing and heat treating, so that without having any work done outside the shop the rough stock comes into the plant and is not taken out until it is sent out by the shipping department ready for use. Combining all of the manufacturing processes under one roof is found to be economical in this specialized plant because of the large production.

Receiving and Rough Stock Room on First Floor, Showing Storage Bins, Chain Hoist and Corner of Shipping Room at the Right

The plant occupies a two-story reinforced concrete building with a street frontage of 110 ft. and 165 ft. deep. The sides are somewhat irregular in shape to conform with the shape of the site. The construction is unusually heavy, the building being designed so that two additional stories can be added when the growth of the business necessitates more floor space. The side walls on all sides are faced with pressed brick, which added considerably to the cost of erection, but materially improved the outside appearance of the building. In order that the maximum amount of outside light may be admitted there are practically continuous windows on all sides, the glass being set in United steel sash furnished by the Trussed Concrete Steel Company, which company also furnished the steel reinforcing material used throughout the building.

Each story is 13 ft. in hight from the floor to the ceiling. The second floor is supported by reinforced concrete columns octagonal in shape and spaced 18 ft. between centers. These columns are 24 in. thick. The second floor columns are similar, but somewhat lighter, being 18 in. in thickness. The ground floor consists of 4 in. of concrete laid on cinders. Instead of having solid concrete floor construction Florodomes or corrugated steel domes are used in the construction of the second floor and ceiling above it, thus saving concrete and largely reducing the floor weight. The second floor is covered with 1⅛-in. maple flooring laid on sleepers bedded into the concrete. A test of this floor made after the completion of the building when the concrete was still green showed that it could stand a load of 500 lb. to the square foot, which is nearly twice the maximum stress to which it will be subjected.

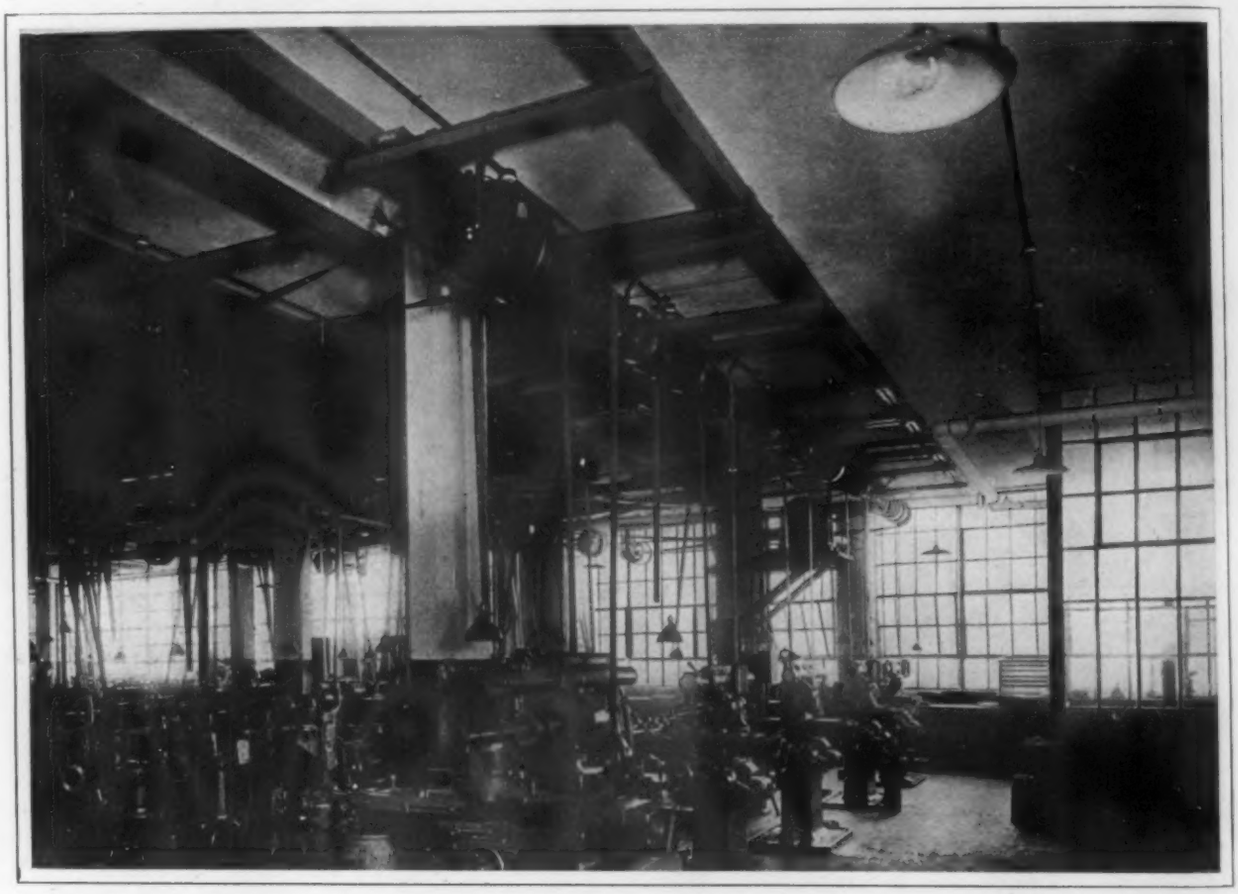
The interior walls and ceiling are covered with water white paint except 5 ft. of the walls from the floor upward, which are painted black. Steel sash extending from the floor to the ceiling and fitted with glass except in the lower section, a distance of about 4 ft., which are fitted with sheet metal, are used for partitions to enclose the general offices on

the front of the first floor and the plating, polishing and heat-treating departments at the opposite end of the plant. Similar partitions on the second floor separate the superintendent's office, drafting room and tool room from the machine shop. These glass partitions aid in the diffusion of light and permit an unobstructed view from the offices to the factory floors. With practically no wood in the building except one floor and the oak office finishings and furniture, the plant can be said to be almost absolutely fireproof. All electrical wiring is placed in steel conduits that are fastened directly beneath the ceilings.

The greater part of the first floor is used for the receiving, rough and finished stock rooms and shipping rooms. Carrying out the plan of eliminating brick or other solid partitions and thus providing the maximum of light and air, the stock and shipping departments are partitioned off with heavy wire screens extending to the ceiling. Material consisting of castings, steel and other stock is taken into the building from a paved receiving and shipping court built in on one side of the building and enclosed across its front by a rolling steel door. The receiving room, which is also the rough stock room, is served by a Yale & Towne 2-ton chain hoist, the runway of which extends from the receiving door to another door on the opposite side of the building, which is also used for taking in stock when needed. The receiving floor is provided with a 2½-ton Howe scale. Rough stock is stored in racks, and specially designed steel racks are used for storing steel bar stock. The finished stock room is provided with racks for large parts and metal cabinets with drawers for small parts. These drawers are properly labeled and a sample of the contents is fastened on the outside of each drawer for convenience in finding the part wanted. Wooden racks are now used in both the rough and finished stock rooms, but these will be replaced shortly with steel racks. The first floor at the side of the rough stock room is connected with the second floor by a 2½-ton Otis electric elevator.

Partitioned off in the rear of the first floor and adjoining each other are the enameling, nickel plating, polishing and heat treating rooms. The main body of a die stock is enameled before the tool is assembled and other parts are nickel plated. The enameling is done by hand and the parts are dried on a steam table. The equipment in the polishing department includes two polishing machines, a handle polishing machine, a grinder and tumbling barrel. The heat treating department is equipped with two Frankfort gas-fired furnaces for case hardening dies and one lead furnace together with the necessary quenching tanks.

The entire second floor with the exception of the space occupied by the superintendent's office, drafting room and tool room is used for the machine shop. The machine shop itself is divided by aisles into four different departments that are particularly four separate and distinct units, each being under a foreman and all under the direction of the superintendent. These are the screw machine, die making, milling machine and fitting and assembling departments. Each department has its motor equipment and control, its soda cleaning apparatus for cleaning work, its tool store room, light switchboard, steel lockers for the men and drinking water filtering tanks. The machinery is arranged in groups and each motor drives a group of three shafts, a main line shaft and two side shafts. Each side line shaft is connected to the main shaft by a Hill clutch so that either side line can be shut down and the other kept in operation. The motors are located on platforms placed near the ceiling.



View of the Milling Machine Department Showing the Method of Suspending the Shafting

Two Rows of Automatic Machines in the Machine Shop

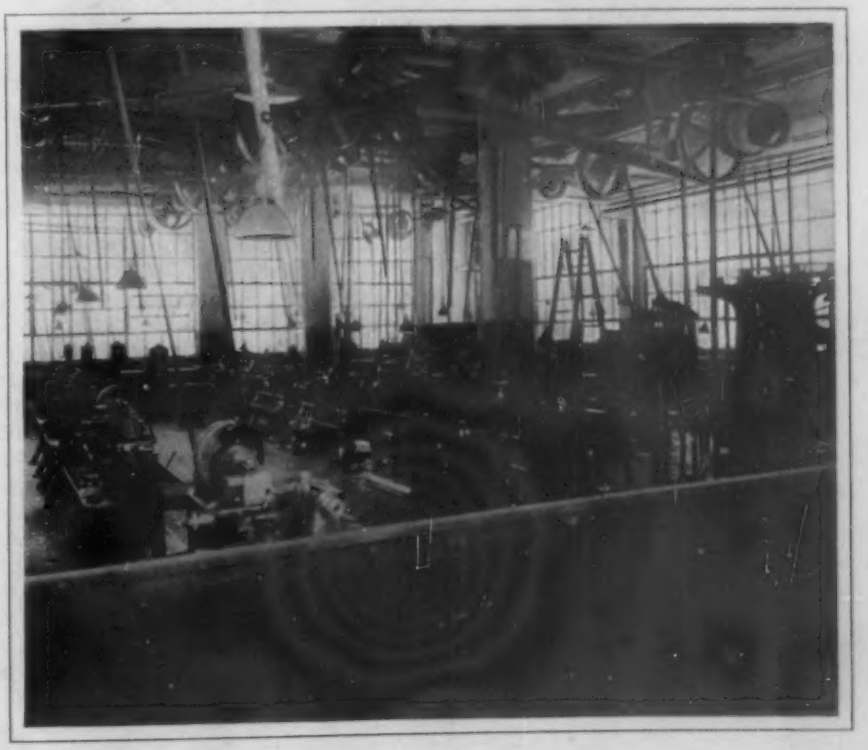
A highly flexible method has been provided for hanging the shafting and countershafting. All over the ceiling spaced 25½ in. each way there were placed in the concrete when the building was erected Knease socket inserts made by the D. A. Wedmore Company, Camden, N. J. Five-in. channels are bolted in pairs to the inserts, the channels of each pair being kept the required distance apart by spreaders and kept from spreading by clips. To the channel stringer beams 3-in. cross beams are bolted at right angles, the bolts being placed in slots provided by the pairs of channel beams. These cross beams carry the line shaft hanger or countershaft hanger and sometimes both. The method of suspending the shafting is indicated in one of the accompanying illustrations. The operation of the machinery with this system of hangers has not resulted in vibration or loosening of bolts.

The superintendent's desk in his glass enclosed office is on a raised platform so that he can look over the entire shop. The drafting room adjoining is provided with a fireproof vault for the protection of tracings and drawings. Adjoining the superintendent's office is a small waiting room for applicants for work.

Rows of benches extend around the side walls of the greater part of the machine shop. These benches have maple tops 30 in. wide and are supported on cast-iron legs made by the Motor Foundry Company, Detroit.

The machinery is arranged for convenience in routing material and for economy in production. The rough castings are first taken to the automatic machine department where the turning and boring operations are performed. This is done on Potter & Johnson automatic machines arranged in two rows. After inspection they are sent to the milling department where the slots are milled for inserting the dies and guides. The milling machines, which are nearly all of the Brown & Sharpe make, are arranged in five rows. The parts are again inspected after which they go to the fitting department where they are broached, filed and fitted up. Next they are enameled and they are then stored in the finished store room from where work is issued to the assembling room according to the requirements of the orders. A third inspection follows the assembling. A large number of specially designed jigs are used in connection with the various machining operations. Material going through the shop is handled with specially designed hand trucks and in steel shop barrels furnished by the Cleveland Wire Spring Company. These barrels have two lugs, so that they can be picked up and carried easily on a special carriage.

A great deal of attention was given to the question of providing adequate artificial interior lighting. Both floors are lighted with rows of 100-watt lamps between the columns spaced 18 ft. apart and suspended a short distance from the ceiling. These lamps have 14 in. Adams-Bagnall Electric Company's Abolite reflectors. In addition there is suspended by a cord over each machine an individual



View of the Die Making Department

25-watt lamp with a deep shade extending just below the lamp that throws the light on the work and affords a protection for the workmen's eyes so that none of them feel the need of using eye shades. The deep shade also protects the lamp from breakage. Looking across the shop room floor one's first impression is that it is poorly lighted as the only lights visible are those near the ceiling, which afford far from a brilliant illumination. This effect, however, is caused by the deep shades that conceal the individual lamps, which furnish an abundance of light on the machines where wanted without tiring the eyes.

The men are provided with adequate lavatory facilities on both floors and with both hot and cold water. There is also a sanitary toilet room on each floor with slate-partitioned closets. A workmen's entrance to the machine shop is provided by a passage way leading to a stairs on one side of the building, the clock for recording the men's time being located in the room at the head of the stairs. The two floors are also connected by another stairway near the front offices. Interior communication between the offices and all parts of the factory is provided by an Interphone system installed by the Western Electric Company. Electrical power for operating the plant is supplied by a commercial company. The building is heated from an Erie City boiler in the basement. The plant was designed by Albert Kahn, architect, Detroit, Mich.

Rapid Determination of Carbon in Steel

A Combustion Method Which Establishes a Record for Speed and Accuracy—Details of Its Manipulation

BY WILLIAM R. FLEMING*

The method described here was first published in *The Iron Age* of January 2, 1913. It is now dealt with more in detail, in reply to many letters from chemists who thought that the first one lacked sufficient detail. Evidently there is a wide variation of opinion among chemists as to the merits of this very rapid method. Naturally this was to be expected for there are always plenty of conservatives on hand to rally around the banner of "standpatism" when something new is proposed. The writer has heard, only indirectly, of a few chemists who have condemned the method. To these he wishes to say that the fault lies not in the method, but in them. It is hoped that those who have written for additional information will find it in this article.

The greatest value of this rapid method is realized when it is used to follow a bath of steel in the open-hearth furnace preliminary to tapping. It abolishes completely the unreliable and dangerous color carbon. By this method absolutely accurate results can be reported to the open hearth 10 minutes after the drillings are received. The great value of this will be appreciated by all chemists, metallurgists, open-hearth superintendents, etc.

CAPACITY OF THE METHOD

To demonstrate the capacity of the method the writer in six hours made 42 determinations on a standard steel containing 1.025 per cent. carbon. Only one combustion train and one absorption tube were used. The highest result obtained was 1.038 per cent.; the lowest, 1.019 per cent. carbon; 33 results were between 1.020 and 1.028 per cent. carbon. The claim is made that this is a record for the number of combustions in a given time with one train and one absorption tube. Furthermore, the consistent results demonstrate completely the remarkable accuracy of the method. At another time 32 determinations were made on a steel containing 0.618 per cent. carbon. Of these, 27 results were between 0.610 and 0.619 per cent. carbon; three, 0.605, and two, 0.624 per cent. carbon. The time required was exactly five hours. Incidentally it might be mentioned that these 74 combustions were made with one absorption tube without renewing the soda lime. The sample taken in every case was 1.5 grams.

In principle this method is not new; in manipulation it is new. Heretofore chemists have been laboring under the impression that the flow of gas during a combustion must not exceed a certain snail-like pace. This false impression has been injected into the minds of chemists by a few who were supposed to have investigated the matter. The truth is that the faster oxygen is fed to burning steel the more complete the combustion will be. The rate of current is limited by the efficiency of the apparatus used to absorb the evolved carbon dioxide. The present method is made possible by the use of an absorption tube which is far superior in every way to any ever devised. Any chemist can quickly verify this statement by purchasing one of every form of apparatus obtainable. Load each and pass a current of air or oxygen through it for 10 min. at the rate of 300 or 400 cc. per min. The writer's absorption tube, or some modification of it, loaded with soda lime and phosphoric anhydride, is the only one which will not lose weight when the current is passing at a rapid rate.

THE APPARATUS DESCRIBED

The combustion train is shown complete in Fig. 1. The oxygen is delivered to the train through a regulating and reducing valve such as is used for welding. The gauge used in this laboratory is made by the Davis-Bournonville Company, New York. It has a 3000-lb. gauge on the inlet and no gauge on the outlet. Linde oxygen in high pressure tanks is used. The regulating valve is not essential, yet any chemist who uses one will appreciate its convenience, especially in this method. Its convenience will be explained later. K is a mercury pressure gauge. It serves as a guide during the combustion and is an essential piece of apparatus. The graduated column is 6 in. high and is divided into eighths. P is a washing bottle containing caustic potash solution. Filled to the mark indicated with 50 per cent. solution it will serve for at least 1000 combustions. It is used solely to indicate the flow of gas, not to purify it. If the chemist desires he may omit this from the train. T is a calcium chloride jar. It is filled to the mark indicated with finely divided cal-

*Metallurgist, Andrews Steel Company, Newport, Ky.

cium chloride, about pea size, retaining all the dust. A layer of asbestos is formed over the chloride and the remaining space filled with soda lime. The glass tubing leading from the jar is loosely packed for a distance of several inches with asbestos. This prevents any soda lime dust being carried into the combustion tube. G is a mercury valve like that used in Johnson's train. It is used solely to maintain an atmosphere of pure oxygen in the purifying train, a condition essential to accurate results. It is not used to prevent carbon dioxide backing into the purify-train, of which there is not the remotest possibility.

The combustion tube is the ordinary fused silica tube glazed on the inside only. The tube is 30 in. long with inside diameter of from ⅞ in. to 1 in. One tube of 30 in. will serve twice as long as one of 24 in. It is loosely packed with asbestos for a distance of 6 in. at the exit end, and 3 in. is allowed to project from the furnace. For about the first 100 combustions the combustion boat is pushed close against the asbestos. The portion of the tube immediately above this will become coated with iron oxide. The asbestos is then moved up so that it covers this portion of the tube and a fresh area exposed to the spraying oxide. In this manner one tube can be made to serve 600 combustions or even more. Both platinum and nickel cylinders have been used inside the tube to protect it from the spraying oxide, but it is doubtful whether this practice pays. These cylinders are not used in this laboratory because it is believed that they delay incipient combustion for at least 30 seconds.

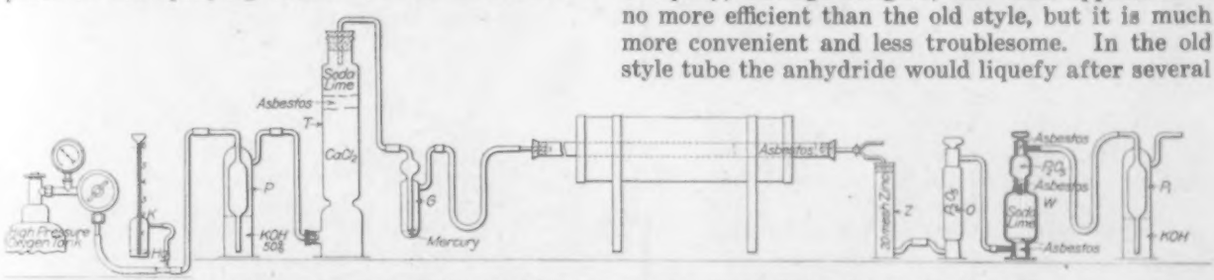


Fig. 1—Apparatus Used in the Rapid Determination of Carbon by Combustion

THE FURNACE AND COMBUSTION TUBE

The furnace used is one of the ordinary resistance type. It is constantly maintained at a temperature of 1000 deg. C. This temperature is verified daily by the use of a pyrometer. Many claim to be expert at judging temperatures, but none are expert enough to be without a pyrometer. The two-way stop following the combustion tube will be found very convenient when it is not desirable to pass the current through the jars Z and O.

Z is filled with 30 mesh zinc. Once filled it will serve for several thousand combustions. As a matter of fact it is included in this train for two reasons; first, as a filter; second, to stop any fumes which might result from a fly getting into the combustion tube with the drillings. If nickel boats and aluminum are used the chemist may omit this zinc jar from the train, for with all ordinary grades of steel it serves no purpose. In fact the writer has not taken the time to ascertain whether it is essential when burning high surphur steels, such as is used in screw stocks, etc. The following experiment demonstrates its utter uselessness when operating on ordinary high carbon steel. The jar Z was filled with zinc, dried at 100 deg. and weighed. It weighed 151.7904 grams. Five weeks later it was weighed again. During this time it had served for 237 combustions. It weighed 151.7940 grams. The gain was .0036 grams, or .00001 grams per combustion. The top layer taken off and examined for sulphur. A trace only was found. However, the jar is harmless in the train and can be used without vitiating the results.

O is the phosphoric anhydride jar. A little asbestos is placed in the lower part just above the lower stopper. The remaining space in the jar is completely filled with phosphoric anhydride. The upper stopper is packed tightly enough to prevent any powder being swept into the weighing apparatus. As the anhydride liquefies it passes down into the lower stopper where it can be removed conveniently without disturbing the anhydride above it. Likewise the anhydride can be replenished by removing only the upper stopper. The jar need not be washed oftener than once in 500 combustions. When filled with anhydride, fresh reagent need not be added for at least 150 combustions. After each combustion the jar should be given a few sharp taps with the hand to prevent canals being formed.

DETAILS OF THE ABSORPTION APPARATUS

The absorption apparatus, shown in detail in Fig. 2, has been modified slightly at the suggestion of Henry G. Martin of the Railway Steel Spring Company, Chicago Heights, Ill. This apparatus is no more efficient than the old style, but it is much more convenient and less troublesome. In the old style tube the anhydride would liquefy after several days and require replenishing. To overcome this Mr. Martin suggested using separate chambers for the anhydride and soda lime so that communication could be broken when the tube was standing idle. The tube shown is the writer's modification of Mr. Martin's suggestion. When properly filled this tube will serve for at least 70 combustions when operating on 1.5 grams of sample containing 1.03 per cent. carbon. Tubes in this laboratory average about 75 combustions before renewing the soda lime. The anhydride in the upper chamber serves for at least 300 combustions. The J. T. Baker Chemical Company furnished this laboratory with a special soda lime containing 2 per cent. moisture in 20, 40 and 60 mesh sizes. This material placed in the tube in alternate layers (about ⅛ in.) of the different meshes has proven a very convenient and desirable reagent. The 12 mesh soda lime for nitrogen, by the same company, can also be used with excellent results. If this is used, part of it should be ground to about 60 mesh and alternate layers of fine and course used. The regular soda lime put out by the Baker Company for CO_2 determination is troublesome to handle, especially in damp weather, and in general is not as desirable as the variety put out for nitrogen determination. It is exceedingly important that the tube be loaded with alternate layers of coarse and fine reagent, for, if the 12-mesh reagent is transferred directly from the bottle to the absorption tube the latter will fail to be effective for more than 30 combustions and in some cases less. The reason for this is evident. The lower stopper is packed loosely with asbestos, also the lower portion of the soda lime chamber just above the stopper. Then, beginning with a layer of 12-mesh soda lime the entire chamber is filled with alternate ⅛ in. layers and coarse reagent. The

small diameter of the anhydride chamber is packed with asbestos and the remaining space filled with phosphoric anhydride. Finally the upper stopper is packed with asbestos. The anhydride chamber, filled as indicated, will not require refilling for at least 300 combustions. It is not necessary to turn the chamber to break communication while the tubes are idle, for the packing of the small diameter with asbestos prevents the absorption of moisture from the soda lime. The tubes must be used in pairs so that one serves as a tare in weighing the other. A pair of tubes assures the operator of at least 140 combustions. A glass or rubber tubing about 12 in. long serves as a guard for the absorption tube. It connects the bottle PI which is used to indicate flow of gas.

The use of clay boats has been abandoned in favor of nickel boats filled with alundum. These are greatly superior to clay boats in every conceivable way. The alundum is labeled as being free from carbon but this is not true. In fact some of it contains considerable carbon. It should always be burned in oxygen at 1000 deg. before using. The boats are formed out of 22 gauge pure sheet nickel. One boat will serve for about 100 to 150 combustions, some more, some less.

DETAILS OF THE ANALYSIS

The furnace being at 1000 deg., the two freshly prepared absorption tubes are placed in the train and oxygen run through at the rate of 300 cc. per min. for 15 min. This insures the displacement of all air from the purifying train as well as the absorption tubes. Remove one absorption tube from the train and turn on the oxygen until the mercury stands at about 2 in. The rate of current is then measured by inverting a graduated cylinder filled with water. Several trials will establish a rate of about 325 cc. per min. Note the reading of the column of mercury at this rate and subsequently, when using the same absorption tube, maintain this same pressure in the train and the rate of flow will be 325 cc., the rate during all combustions. Shut off the oxygen and, when it comes to a slow bubbling through PI, close the upper stopper of the absorption tube. Disconnect it from the train, but do not close the lower stopper for about five seconds after disconnection. Weigh against its mate as a tare. It is now ready for the first combustion.

Fig. 2—Detail of Absorption Apparatus

Weight 1.5 grams of drillings, preferably thin, curly drillings from a twist drill, and spread out in the nickel boat which is half filled with alundum. Place the absorption tube in the train and place its mate beside it. With the oxygen flowing about 100 cc. per min. the drillings are pushed into the combustion tube. The current is immediately run up to the desired pressure which gives 325 cc. per min. The regulator will do the rest. It will feed the oxygen automatically to the burning steel. As a rule the drillings are entirely burned one and one-half minutes after insertion. Continue the flow of oxygen for three and one-half minutes more (five minutes total time) and disconnect as before the absorption tube. Weigh immediately. The result will be accurate and reliable. Whether determining carbon in a standard steel, where the greatest accuracy is required, or in a bath test, the time required is always five minutes.

It has previously been stated that the use of nickel cylinders within the combustion tube was believed to delay incipient combustion. Mr. Martin has informed the writer that he constantly uses a nickel cylinder to protect his combustion tube and that, in his opinion, it does not delay combustion to any appreciable extent.

The weight of the boat, plus refractory lining, should be kept as low as possible so as not to introduce too much cold material into the combustion tube. The boats used in this laboratory are ½ in. wide, ¼ in. deep and 3 in. long. Sheet nickel varies in percentage of carbon. As a rule, a nickel boat must be ignited in oxygen at 1000 deg. for one to two hours.

There seems to be a difference of opinion concerning the physical condition of the steel after burning, some chemists believing that inaccurate results are obtained if the drillings have fused during combustion. Others maintain that complete fusion of the drillings is essential to accurate results. The writer has never heard of any plausible reason why fused drillings should cause inaccurate results. They are, perhaps, caused by the same influences which enable carbon monoxide to escape from the tube during a too rapid feeding of oxygen to the burning steel. The writer has shown this oft-expressed opinion to be a nightmare and likewise wishes to say emphatically that the idea about fused drillings is also a nightmare. On the other hand, if drillings which happen to be a little thick are used, low results are obtained unless the drillings are *perfectly fused*. After doing a great amount of work on this subject the writer wishes to state positively that accurate results are more likely to result from fused than unfused drillings. Mr. Martin, in a recent letter, deals with this subject very clearly. He says: "I know chemists who reject any result coming from a determination which has fused, or partly fused, during a combustion. Partial fusion I also think is a bad thing, but a point that should appeal to the reader would be the fact that even in the short time required here the charge becomes perfectly fluid so as to run together much as mercury would gather into one globule. This complete fusion I think very essential to a correct result. Now, a point that appeals to me is that the need of very fine drillings, such as we always had to have for the slow oxidation method, with this new and rapid manipulation, are no longer essential. This fact helps out wonderfully when you receive a lot of outside samples, the drilling of which you cannot control." Mr. Martin states that he prefers the use of emery to alundum, because the former does not fuse so freely with the steel.

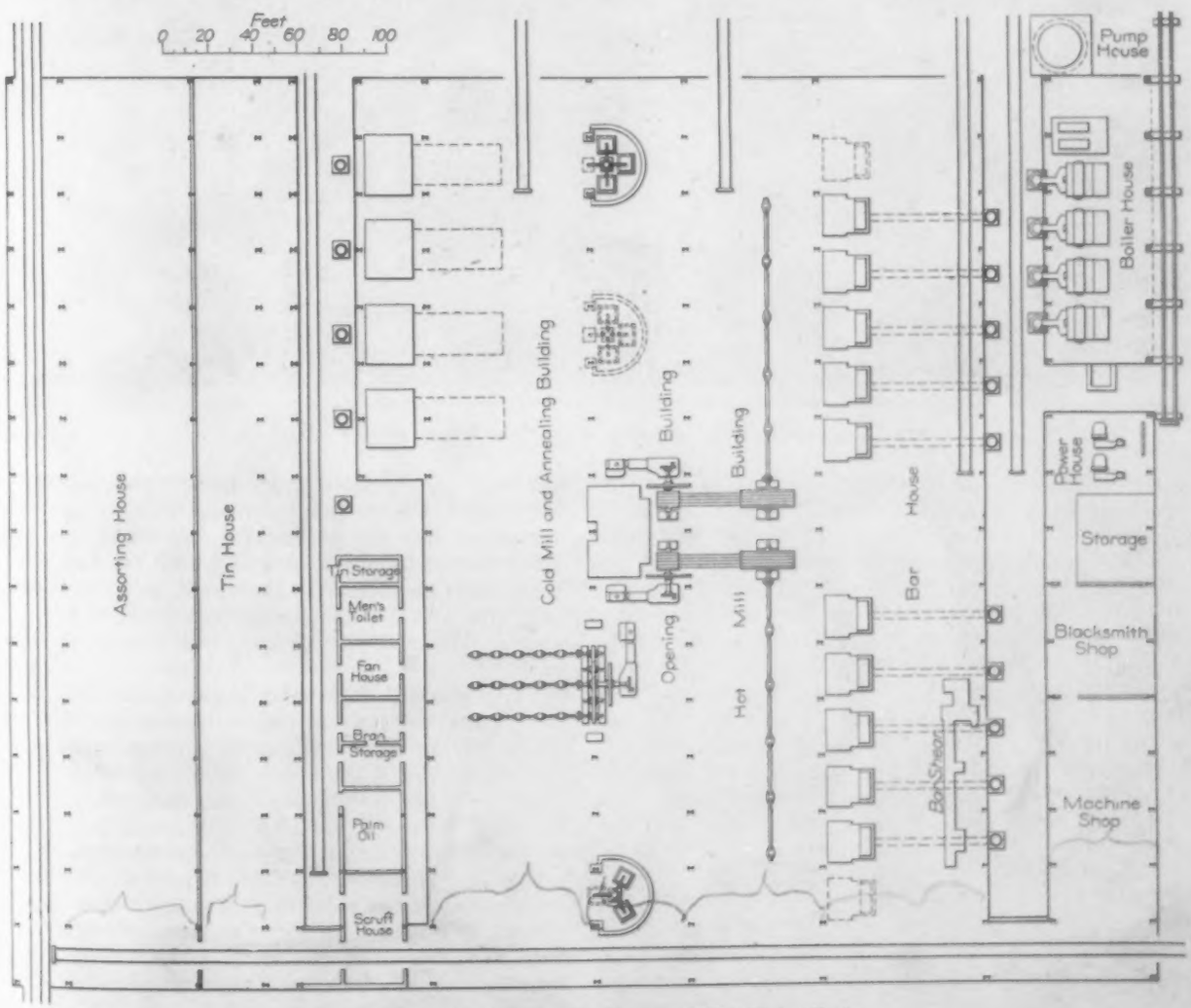
The electric furnaces used in this method are made from a piece of 4-in. pipe 15 in. long. The resistance wire, No. 18 gauge Nichrome II (80 ft., 220 volts) is wound around an alundum tube 15 in. long, 1¼ in. in diameter. The wire is wound around the tube in spiral form, sheet asbestos wrapped around it and dry alundum cement poured in around the wire. The remaining space in the furnace is packed with magnesia. Since the multiple unit furnace has been improved by placing the connections away from the heat, the writer recommends these furnaces to those who do not want to take the trouble to make their own.

The Wheeling Sheet and Tin Plate Works

The Progress in Plant Design Typified—Unusual System for Transferring Material—An Annual Capacity of 1,000,000 Boxes

A new sheet and tin plate mill that is distinctive in its special features and that is built according to modern ideas calculated to insure production at a minimum cost has just been put in operation at Yorkville, Ohio. Five of its 10 hot mills were successfully started Monday, December 15, and the remainder are expected to go on early this month. It is entirely a Wheeling, W. Va., enterprise, money for the plant having been raised wholly in the Wheeling district, and in a very short time, too, testifying very strikingly to its public spirit.

The moving factor in the launching of this new undertaking is Isaac M. Scott. Early in the fall of 1912, Mr. Scott, who had a short time before resigned as president of the La Belle Iron Works, Steubenville, Ohio, with a number of associates, organized the Wheeling Sheet & Tin Plate Company, with a capital of $1,000,000, for the purpose of building a modern sheet and tin mill plant. He has had a large experience in this business, some years ago having been connected with the Beaver Tin Plate Company at Lisbon, Ohio, which was after-



General Plan of the Wheeling Sheet and Tin Plate Works

wards taken over by the American Sheet & Tin Plate Company; later he was with latter company in an official capacity.

S. Diescher & Sons, consulting engineers, Farmers' Bank building, Pittsburgh, were engaged as the engineers for the building of the plant. The site, selected at Yorkville, Ohio, is situated about seven miles above Wheeling on the Ohio side of the Ohio river. The ground contains approximately 45 acres and lies between the Ohio river, the Wheeling & Lake Erie Railroad, and the Cleveland & Pittsburgh branch of the Pennsylvania lines West. It was splendidly adapted for manufacturing purposes on account of its being entirely level and 10 ft. above the highest flood stage. The railroad sidings of the plant connect with both the Wheeling & Lake Erie and Cleveland & Pittsburgh railroads. About 10 acres have been fenced in, which is occupied by the buildings and track system. Foundations, engine capacity, buildings, and, in fact, the entire plant is arranged for 12 hot mills, 10 of which have been completed and the two additional mills contemplated can be added at any time, the only cost involved being the two stands of rolls and two heating furnaces. Reference to the accompanying ground plan will give a clear idea as to the general arrangement of the plant.

The Catchers' Standing, Showing the Hot Mill Drive Toward Background

This arrangement is largely different from that of any other existing plant for making tin plate. The sheet bar building is located parallel with and alongside the hot mill building, and the assorting and warehouse are parallel with the tin house. The sheet bars are brought in on the railroad track in the bar house, where they are unloaded on skids arranged throughout the bar mill building. From these skids they are taken, by means of a 20-ton crane serving the entire building, to the bar shear, built by the United Engineering & Foundry Company of Pittsburgh, where they are cut to the required lengths; are then piled on portable packs, which are carried by the crane to positions between and at the front of the sheet and pair furnaces, where they are easily accessible for charging into the furnaces. Along the south end of the plant, located in the last bay and across and through all buildings, is a transfer track on which transfer cars are carried throughout the entire length of this track as requirements may demand. The principal use to which this system is put is for carrying the material from the white pickler into the tin house. However, this transfer system also serves for carrying black plate that is to be shipped, out of the hot mill department into the warehouse, and it will also carry any material or machinery requiring repairs from any department into the machine shop. The cars used on the transfer have each a capacity of 20 tons, this being the standard capacity of all the cranes in the plant. The track is standard gauge, and the locomotive used is of the Westinghouse-Baldwin type, and built for the simplex system of conductors. Provision is made for storage batteries, so that the locomotive can be run on any track served by the cranes and used for any emergency requirements that may come up. The storage batteries are not in use on the transfer track, a special system of electric conductors being installed on it.

The hot mill department is arranged in a manner similar to general tin mill practice. The engines driving the hot mills are located in the opening building, and the space not occupied by the engines in this building serves as the opening floor. The cold mills are provided with the Steele patent conveyors. The annealing furnaces are stoker fired, using the American underfeed stoker. The hot mills and also the cold mills were furnished by the Wheeling Mold & Foundry Company, Wheeling, W. Va., and are of very heavy construction. The housings are of cast steel, weighing 30,000 lb. each, the rolls are 28 in. in diameter, and the housings

are equipped to accommodate 30 in. diameter rolls, should it be found desirable later to install rolls of this size. There are three trains of cold mills, the rolls being 26 in. in diameter, arranged in tandem and driven from the gear train, as shown on the plan. All anchor bolts securing any machinery relating to the hot mills, hot or cold mill engines, gear drive, and, in fact, anywhere where there is danger of a bolt breaking or becoming loose, are accessible underneath through the foundations by means of tunnels of sufficient hight and breadth so that a man can walk through them upright, the entrance to these tunnels being in the pit between the hot mill engines. The steam tunnels are of concrete construction, and are 6 ft. wide and 8 ft. high, and all tunnels connect with the pit between the hot mill engines. The rise in temperature in the steam tunnels due to radiation from the steam pipes, which are all covered with insulating material, has been found not to be great enough to make it uncomfortable for workmen, whose duties require them to enter the tunnels.

There are 10 sheet and pair furnaces designed and erected by the George J. Hagan Company, Pittsburgh, and they are of the independent type, with a solid bottom of fire brick with down draft, and designed for stokers to be applied at a later date. They are of extra heavy construction, built on substantial reinforced concrete foundations, and are bound with steel plates, castings and structural shapes, tied, bolted and riveted, with the usual allowance for expansion and contraction. The stacks for the furnaces are located outside of the building, and are connected to them by underground draft flues, which are subject to the control of two dampers, one at each furnace and one on top of each stack.

The box annealing furnaces are of the Hagen stoker fired type, and there are eight single furnaces, two in a battery. Each battery of furnaces will accommodate four 5-ton pots in each compartment. Each furnace is equipped with two American stokers, which feed nut or slack coal of any desired quantity at an even flow or speed, and the correct amount of air is fed automatically in accordance with the coal fed or temperature desired. Means of control are such that an absolutely uniform temperature is maintained in every square foot of heating chambers, thus insuring a perfect anneal for every sheet. There are no stacks passing through any of the roofs, all being located outside the buildings. The waste gases from the furnaces are led to the stacks through underground flues. In the case of the boilers, the breeching back of each one is directly connected to an individual stack, each stack serving one boiler.

The picklers are of the standard self-supporting Mesta type, two 4-arm picklers being used for the black pickling and one 3-arm pickler for white pickling. The tinning pots are heated by natural gas, which is the only equipment in the plant using this as a source of heat. It will be noted by reference to the general plan that there is one extra stack in line with the annealing furnace stacks. This serves for all the tinning pots, and the waste gas from the furnaces under the tinning pots are all led to this stack through underground flues. The width of the tin house is approximately 30 ft. and the hight to the bottom chord is 32 ft. There is a wide monitor ventilator on top of the tin house roof, extending its entire length. This monitor is provided with the Lupton metal sash and operating devices. All the windows on the entire length of the tin house monitor can be quickly opened or closed from either end of the building. The operating device is controlled by a chain and handled from the floor of the tin house from either end of the building.

The tin house has one row of tinning machines and provision has been made for 23. The present installation consists of four 66-in. machines, seven

The Heating Furnaces and the Hot Mill Standings

72-in. and four 80-in. machines. These machines are provided with catching and conveying devices of a special design, which carry the plates to the polishers, the polishers being located at the partition wall between the tin house and the assorting house, and which deliver the plate into the assorting house on the assorting tables. After the plates have been assorted they are boxed at the tables without any further handling, and from this position can be trucked directly into the railroad cars on the track entering the leanto of the warehouse. This is a depressed track and is the only one depressed in the entire plant, the level of the shipping floor being the same as that of the car floors.

The boiler plant contains four 500-hp. vertical water tube boilers, each boiler containing about 5100 sq. ft. of heating surface and designed to carry 170 lb. safe working pressure. Each boiler is suspended from an independent frame work, and arranged so that each tube can be readily removed.

View of Cold Mills

A boiler consists of two horizontal drums connected together by means of curved banks of tubes properly baffled, so that the gases before entering the stack make three passes in contact with the tubes. A feature is that the feed water entering the lower drum in an enclosed feed box travels upward at a slow rate through the two rear banks of tubes coming in contact with the gases, just prior to their leaving the boiler. As a result of the slow rate of feed, scale forming compounds are precipitated in these two rear banks of tubes and slowly gravitate into the feed box, from which point they can be blown off, thereby largely preventing the formation of scale throughout the general circulatory system of the boiler.

The handling of the fuel, steam and water is a feature. The coal is brought in on an elevated track, shown on the plan, parallel with and outside the boiler house. This track is 15 ft. above the boiler house floor and pits beneath give the required coal storage. The feed water heaters are located in the opening building between the two hot mill engines. The water required for the operation of the plant is pumped from the gravel beds, which extend 80 ft. under the ground. The pump house is located at the north end of the boiler house and provision is made for two 1,000,000-gal. Wilson-Snyder pumps in it. The water is pumped to a 100,000-gal. elevated tank, 100 ft. high, located about 100 ft. from the south end of the main building line, from which it is distributed to different parts of the plant. The steam mains run parallel with the length of the boiler house and through the south wall of the boiler house and into the power house, and are suspended from the trusses of these buildings. In the power house, the main steam line is led under the floor at a point on the central line between the two hot mill engines. The steam main is led underground through a tunnel, passing under all floors and under the engine room floor to a large receiver, located in a pit between the two hot mill engines. From this receiver, all steam lines leading to the other engines are carried underground. The exhaust lines are also led underground, rising up to the heaters, the free exhaust lines passing between the crane girders of the opening and the annealing buildings. The feed water lines pass through this steam tunnel back to the boiler house and carry the feed water to the Wilson-Snyder feed pumps, located in the pit at the north end of the row of boilers.

The power house and blacksmith shop take their steam from the steam main before it descends into the tunnel. There are two 200-kw. units in the power house and an 800-lb. Bement-Miles steam hammer in the blacksmith shop. The row of buildings of which the power house is a part are used for the following purposes: power house, store house, blacksmith shop and machine shop. There is a crane runway passing through a part of the building, serving the machine shop principally.

The coal pit under the elevated track, located between the boiler house and the power house, is for storage of the coal used in the sheet and pair furnaces. This coal is carried by an underground conveyor to a pit in the bar house, from which point it is distributed by means of buckets to the sheet

and pair furnaces, this being done by the bar house crane. This crane is also used for carrying away the ashes from the sheet and pair furnaces, the ashes being loaded on a railroad car shifted in on the bar house track. The coal for the annealing furnaces is taken from the cars on the track located between the tin house and the annealing house.

The hot mill engines are of the single-cylinder horizontal double-ported Corliss type, made by the Bass Foundry & Machine Company, Fort Wayne, Ind. The diameter of cylinder is 32 in. and the stroke 60 in., and the engine operates at 75 r.p.m. and is arranged for rope drive. The flywheels are 20 ft. in diameter, weighing 75,000 lb. and in addition to this flywheel there is a rope wheel 9 ft. 3 in. in diameter, grooved for 28 2¼-in. ropes, mounted on the engine shaft. The main bearings are 19 in. x 38 in. The shafts are 23 in. diameter between the main and outboard bearings. With each engine is provided a jack shaft on which is mounted a rope wheel 24 ft. in diameter, grooved for 28 2¼-in. ropes. This jack shaft is operated from the 9 ft. 3 in. rope wheel on the engine shaft, and there is a steel clutch coupling on one end of the jack shaft to which the roll train is connected. The jack shaft pillow blocks are exact duplicates of the engine outboard pillow blocks, making all the parts interchangeable.

The Cold Mill Drive

In addition to the two hot mill engines, there is a cold mill engine of the same type and size, and is fitted with a gear pinion on the main shaft operating the gear train, which in turn operates the different trains of cold rolls. All the details of the cold mill engine are exact duplicates of the hot mill engines, which makes it convenient when carrying spare parts in stock, since all parts on all the engines are interchangeable. The bed plates on all of the engines are made specially heavy, and are amply strong to withstand the strains they will undergo. The engine shafts and jack shafts were made by the Bethlehem Steel Company.

The power plant is complete and compact, and current for motors throughout the plant, lighting and general power purposes is furnished by two-kw. 250-volt direct-current Westinghouse generators direct connected to 18 x 19-in. single-valve side-crank Ames engines, manufactured by the Ames Iron Works, Oswego, N. Y. These engines, which operate at 200 r.p.m., are heavy and arranged to carry severe overloads. All bearing surfaces and pins are extra large for the service contemplated, and considerable attention has been given to a design suitable for continuous service under extreme conditions. The main switchboard in the power house and the distributing boards iu various parts of the plant were all furnished by the Mutual Electric Company of Wheeling, W. Va. All wiring was installed by the electricians of the new company. The entire plant is operated by Westinghouse motors of constant and variable speed.

The complete piping system in the plant, consisting of steam, exhaust, boiler-feed, blow-off and water-piping, was furnished and installed by the Best Mfg. Company of Pittsburgh. The steam specialties in the general piping layout consist of Austin separators, Murray pump governors, Wright traps and high and low water alarms of the Wright Mfg. Company, Detroit, and Hochfeldt non-return valves.

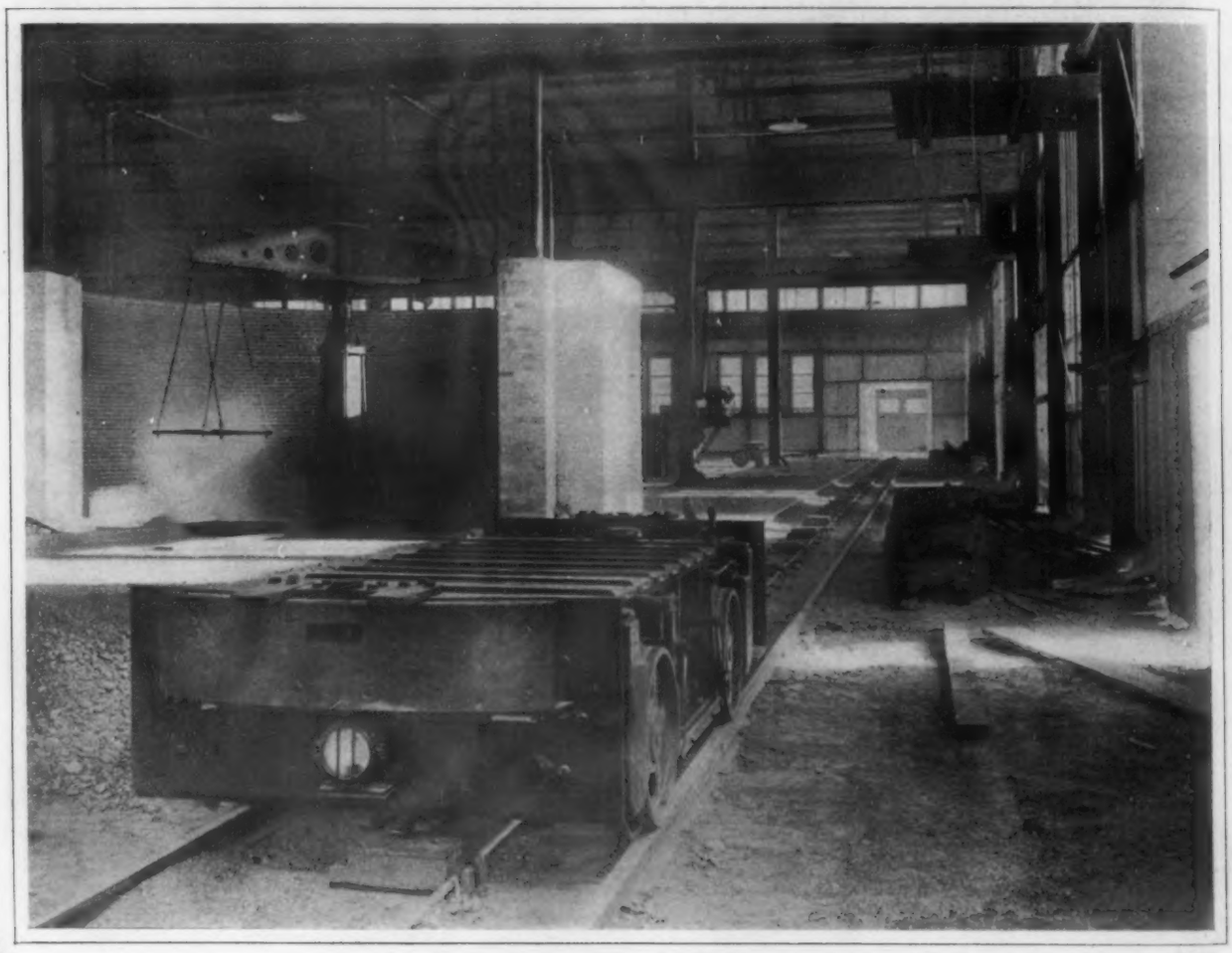
The plant as at present constructed consists of the three main buildings, all brick clad with steel frame, window sheeting and composition roof. The building containing the power house, boiler house, store house, blacksmith shop and machine shop measures 42 ft. to centers of rails with chord hights throughout of 32 ft. and the length of this row of buildings is 400 ft. The tin house is 32 ft. span with 15 ft. leanto, the assorting house 75 ft. span with 25 ft. leanto. The bar house is 75 ft. span, the hot mill building 57 ft. span, the opening building 45 ft. and the annealing building 75 ft. span, all having a chord hight of 32 ft., and a length of 400 ft. The buildings are high with ample provisions for light and ventilation. The entire plant is illuminated at night time by Tungsten lights, which are suspended from the crane columns, roof

trusses and brackets attached to the buildings, no posts being used anywhere for supporting lights.

The building located between the annealing house and the tin house contains the following departments: palm oil house, bran house, fan house, block tin house, scruff house and a wash room for the workmen. There is also a wash room and dining room in the assorting house for the assorting girls. The sanitary provisions are located near the center of the plant and are easy of access.

Palm oil, block tin and bran are brought into the plant over the tracks between the annealing building and the tinning house. The palm oil is stored in a cellar, extending 100 ft. of the length of the above intermediate building. This cellar is of sufficient capacity to take care of palm oil requirements for six months run of the plant. The fan house, which is located next to the block tin vault, contains a fan of 80,000 cu. ft. capacity, which system heats and ventilates the assorting house and tin house. The exhaust steam from the cold mill and hot mill engines may be led into this building through lines located in an underground tunnel, the steam then passing through a bank of tubes at the suction end of the fan, where in the usual manner the air is heated and then forced by the fan into the tin and assorting house through another underground tunnel. This air is distributed along the walls of the assorting and warehouse through galvanized steel conductors set under the crane girders, and connected with this tunnel by means of galvanized steel risers. Nozzles are provided along the entire length of the distributing conductors, which drive the warm air downward. The escape of this air takes place through the windows of the tin house monitor.

The Lawrence Steel Construction Company, contractors of Pittsburgh, had the general contract for the erection of all buildings above the foundations, while the structural steel was fabricated by the Fort Pitt Bridge Works, also of Pittsburgh. The Lawrence Steel Construction Company also furnished and erected the corrugated steel work, wood work on windows and doors, brick work and all miscellaneous materials to complete the structures. The skylights and gutters were furnished by the Thomas W. Irwin Mfg. Company, Pittsburgh, and the metal windows and operating devices by the David Lupton's Sons Company, Philadelphia. The standpipe for water was built by the Des Moines Bridge & Iron Works. The foundation work was erected by Alex. Dixon & Brother, Martins Ferry, Ohio.



Transfer Locomotive, Using Simplex System of Conducting

The plant when running full with 12 mills will have an output of about 1,000,000 base boxes of bright plate per year. The company is erecting an office building, equipped with modern conveniences, which it expects to occupy within a very short time. The officials of the Wheeling Sheet & Tin Plate Company are Isaac M. Scott, president, and F. W. Henderson, secretary and treasurer. E. T. McNulty, formerly of the Washington Tin Plate Company, Washington, Pa., is general superintendent.

According to the statistics of the Department of Commerce of the United States, the total value of merchandise exports for the month of November was $245,645,895, while the total value of imports amounted to $148,594,741, showing an excess of exports over imports of $97,051,154. While this excess is less than that of November, 1912, which was $125,149,293, it is much above the average.

Some Experiences with American Exporters

Adverse Criticism of Packing for Export Not Warranted — Suggestion of Turkey as a Market for This Country's Manufactures

BY JOHN R. ALLEN*

From time to time articles have appeared, particularly in magazines dealing with the export trade, criticising the American manufacturer in regard to his shipments. This criticism has been made in regard to the care with which the shipments have been billed and also in regard to the care in packing. Much of this criticism may be just, but it may interest the readers of *The Iron Age* to know my own experience.

For two years I have been doing construction work abroad and importing into Constantinople, where the work has been going on, machinery and materials, principally from the United States, but also from England, Germany and France. I went to Europe with the impression that much more care was taken in making shipments in Europe than in this country, particularly in view of the magazine articles which I had read. I came back from Europe with an entirely different opinion. By far the best packing that I had came from the United States. In one instance I received 65 packages of machinery containing a great deal of machinery shipped in small pieces—not a single package nor a single article was missing, and not a single box was broken.

In another instance, we received an engine and generator completely erected with even the oilers on. This machinery was carefully packed in a double boarded tar paper lined case. When received the case was upside down and the skids on which the machinery, weighing 12 tons, was supposed to rest, were up in the air. It seemed impossible that some injury had not been done to this machinery in view of the careless handling it had received. Before tearing off the case from the machinery I found it necessary to roll the whole case containing the engine and generator. This would look like a risk perhaps, and no doubt it was. But when the case was unpacked, much to my surprise everything was in perfect order and the machinery was set on its foundations and at once put into operation, without having any of the parts removed or inspected other than opening the cylinder. These are but two examples. I might cite many others of the very excellent way in which experienced American exporters pack their goods.

TOO ECONOMICAL IN PACKING MATERIALS IN EUROPE

On the other hand, I received from England a crankshaft with the armature pressed on. When it arrived on the ground, the case was almost entirely destroyed, and before we could put it into the plant it was necessary to rebuild the case and build skids upon which to move the parts. Over half the cases received in this shipment from England were broken, and while there was little damage done to the goods, it was more a case of luck than of care. I had similar experiences with goods received from Germany and France. The difficulty in all these countries seems to be that in packing they are too economical in materials and nails; their tendency is to cut down on expenditures of this kind, much to the detriment of good packing.

We often hear American manufacturers criticised for lack of care in details of construction and in the drawings of their machinery sent out. From my own experience I do not believe that this is entirely an American characteristic. In the machinery received from the United States I never found it necessary to drill holes or make changes; the parts of the machinery went together perfectly and all that it was necessary to do was to use a screwdriver and a wrench. This was not true of all the machinery I received from Germany and England. In one case of machinery received from Europe the manufacturer had forgotten to drill and tap eight different holes in parts of the machinery, and we were obliged to drill those holes before we could use the machinery. In the case of an engine, supplied by a European manufacturer, it was necessary to tear down part of the foundations and entirely change the location of two of the foundation bolts, owing to an error in the drawing.

From my own experience in Europe and in the United States I feel that the criticism of American manufacturers arises largely from the jealousy of European manufacturers, particularly the Germans, who are very much afraid that the American manufacturer will invade their markets. This is particularly true in Turkey, where the German feels he has an exclusive privilege and where the American manufacturer has never made an effort to get business. As an example of this condition, in Constantinople about 25 per cent. of all the small hardware and tools sold are made in America, but almost none of these tools is sold by Americans. They are all sold through the Germans, and the German is fearful that the American manufacturer may wake up to the fact that in Constantinople there is a large market for the export of his goods; for this reason the German does everything he can to discourage the merchants of Constantinople from purchasing American goods and looks to see that all possible criticism that can be is made.

THE ONE DIFFICULTY WITH THE AMERICAN MAKER

One difficulty I did have, however, with the American manufacturer—he does not always follow instructions. For example, at the present time in Turkey there is required a certified bill of lading with a certain form of certification on it, also a certificate of origin signed by the Chamber of Commerce in the city in which the goods are manufactured or by the American Consul. This is necessary in order to get the goods through the custom house without paying excess duty. Many American manufacturers have entered into controversy with us in regard to the necessity of such a procedure, and there has been some difficulty before the proper papers could be obtained.

The American manufacturer should give a more thorough study to the different foreign markets. I am sure that, if he will do this, he will find many profitable markets and an increasing demand for his product. Turkey is one of the few countries in Europe where there is no fundamental prejudice against American goods and where Americans can enter the field on equal terms with Europe.

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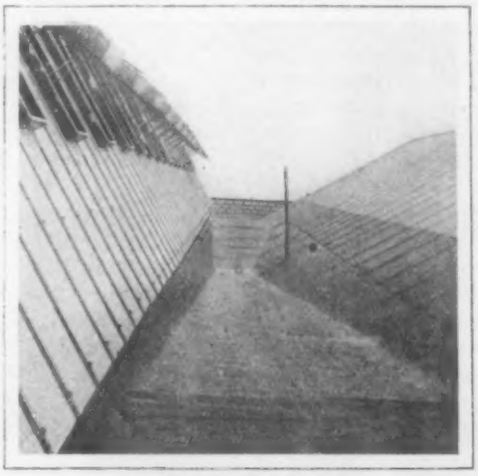
The American Chain Company's New Factory

A Highly Developed Routing System—Practical Suggestions of Efficient Factory Conveniences Produced on the Premises at Low Cost

The new plant of the American Chain Company, at Bridgeport, Conn., furnishes instructive suggestions as to what can be accomplished as a result of careful preliminary planning, in procuring a maximum of efficiency in the routing of the product from the receipt of the raw material to the final shipment of manufactured goods. The factory also contains interesting examples of conveniences and equipment — many of them produced by employees from the designs of the company's engineers—which are used in the handling and in the storage of materials. The problems of lighting, ventilation and general hygienic conditions have been worked out most successfully. The plant is the concentration of an industry which until very recently had been distributed through factories in several cities. The American Chain Company manufactures the chain used by the Weed Chain Tire Grip Company, as well as several standard types of its own special development.



The Degree of Accessibility from a Valley of the Roof

lighted working basement and sawtooth roof. The galvanizing, heat treating and electroplating buildings are each 26 x 100 ft. Plans also call for the housing of the tumbling department in a separate building.

At present all manufacturing is carried on in the west wing. Broadly speaking the company make two types of chain, the material for one of which is round wire, and for the other flat stock. The manufacture of the latter will be concentrated in a part of the east wing when the building is ready for occupancy, and the present wing will be devoted exclusively to chain produced from wire. The storage of all raw material, for the time being, is confined to the basement of the west wing, but when the departments are separated, flat stock will be kept in the basement of its own building.

The raw material is received from cars at the loading platform and is lowered to the basement either by the

Section of a Wing of the American Chain Company's Factory, Showing the Saw tooth Roof

The works, shown in the accompanying plan, are not fully completed. The main building and the west wing, together with the galvanizing building and the power plant, are in operation, and as the remaining structures will be erected in the spring, the description will in a general way deal with the plant as a completed unit. The main building is 50 x 206 ft., 3 stories and basement in hight, and the ells are each 110 x 242 ft., 1 story, with well-

elevator, located at that end of the wing, or by a chute. The latter contrivance adds greatly to the economy of effort in handling heavy bundles. It consists of a long, narrow, shallow three sided box, which, when in use, extends from the level of the platform diagonally to the entrance of the elevator well on the basement floor. The elevator platform is lowered to a point where it serves as an intermediate support for the chute. The coils of wire

and flats are received directly upon trucks which carry them to their respective bins. The chute is not so heavy that it cannot be put aside easily when its services are not required.

The company maintains a running inventory of all materials and products, finished or semi-finished. Upon the receipt of material at the bin, its weight having been determined, an entry of the amount is made upon the bin stock record card, a copy of one of which is here shown. When stock is withdrawn from the bin, the card is debited with the amount. Material of every sort is carried at all times to an amount required for three weeks' consumption. The stock card contains an entry of the minimum amount which will afford this supply, and the maximum that it is desirable to keep on hand. As soon as a card shows that the minimum has been reached an order is put in for the amount which will bring the stock up to the maximum. Of course, at times it may be desirable to buy on a hand to mouth basis, but as a rule quantities are made as large as possible in order to secure the most advantageous terms. The same general system of maintaining stocks prevails in the store-rooms where manufactured products are kept.

The wing has an elevator at each side as well as at the end. Under existing conditions, with both departments in the one building, the round wire goes to the west elevator, because the machinery for which it is destined is grouped on that side of the building, and for the same reason the flat stock goes to the east elevator.

The General Layout of the Completed Works

BIN STOCK RECORD CARD.

Stock 14 Ga Wire Bin No. 8

Lot No. 2450 Estimate 100 ft. 387#

Max 400000# Min 200000#

REC'D	DATE	USED	DATE	ON HAND LBS.	ON HAND PCS.
				50000	Nov 10
90490	11/11	5256	11/11		
97783	11/12	10099	11/12		
		6508	11/13		
		6482	11/14		
		3362	11/15		
65000	11/17	5909	11/17	228108	Nov 17
		6455	11/18		
		10051	11/19		
		10136	11/20		
		6856	11/21		
		8907	11/22	185703	Nov 22
65900	11/24	4984	11/24		
		10298	11/25		
		12105	11/26		
30691	11/27	5277	11/27		
		8215	11/28		
		10638	11/29		
454?4	12/1	-		285201	Dec 1

Bin Stock Card, which Carries the Running Inventory Record

The material after leaving the machines, converted automatically into chain, is returned to the basement and delivered either to the large room where the tumbling processes are performed, or to the stock room for semi-finished products. Mention may be interpolated of the care taken in guarding against danger from fire in the tumbling department. The sawdust used in the process is always a hazard. Impregnated with oil and particles of metal, it furnishes a constant menace from spontaneous combustion. At the end of each working day all the sawdust in the room is placed in metal barrels and is stored out of doors. Each day's work of the department is considered as an individual operation, completed with the exception of chain, the tumbling of which is not finished.

The product of the manufacturing departments is carried by trucks to the basement of the adjoining main building. On the south side is an elevator, on the opposite side a barrel hoist. The material is taken by the elevator to the third floor, from which it passes, as it is needed, to the floor below, where the various assembling processes take place, converting the chain for the multitude of purposes for which it is to be used, and here also it is measured, cut up and made ready for shipment. With the completion of the east wing the product will flow from the basement upward to the top of the main building and will make its final exit from the plant downward through the various departments to the cars

Scrap Conveyor on Loading Platform; a Concrete Railroad Buffer Protects the Frame Building

General Character of the Rough Timber Storage Bins for Wire and Flat Stock

which will of course convey it to the customers.

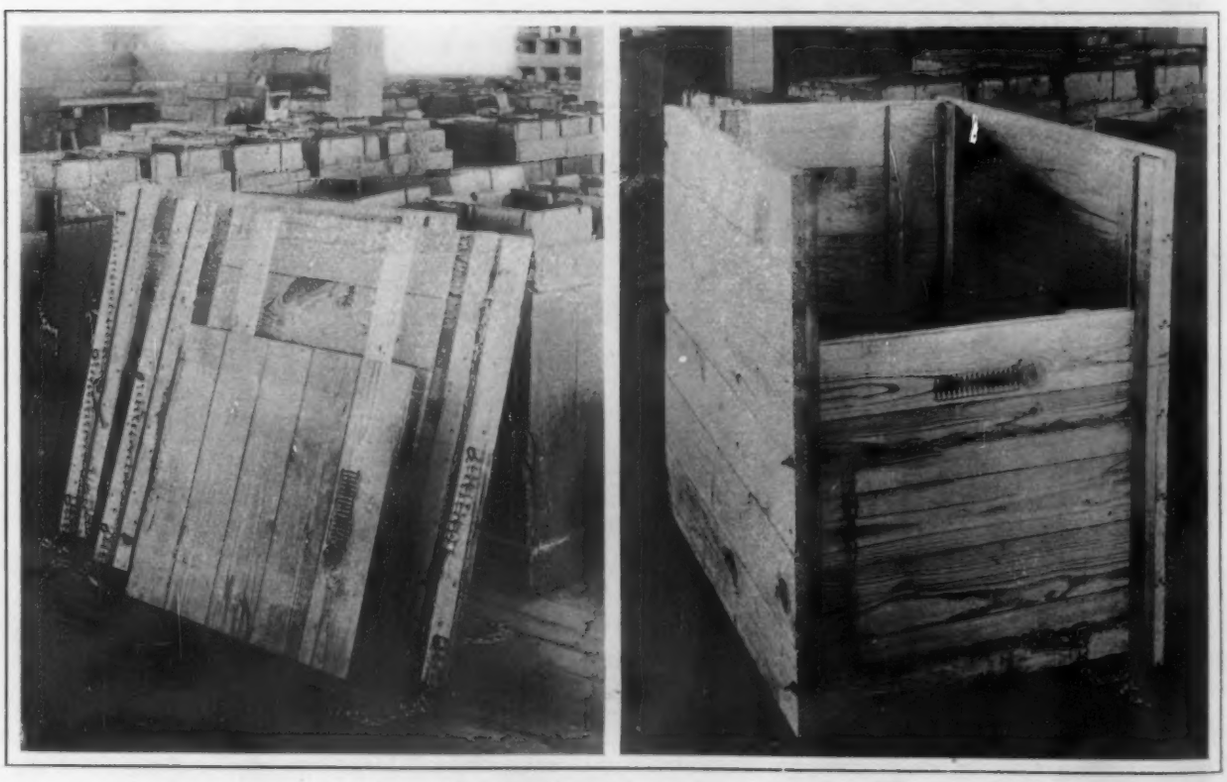
The loading platform is unusually complete in point of capacity and in its convenience for the receipt and shipment of materials. It covers the entire length of the building and is extended along the side of each ell, to form a long shallow U. The spur track from the main line of the New York, New Haven & Hartford Railroad gives a capacity of 13 cars within the yard gates and of eight cars on the main platform. The platform space on the sides of the ells is chiefly useful for the storage of scrap pending its shipment. At the railroad end of this space is a scrap conveyor of the bucket type, furnished by the Dodge Mfg. Company, which handles the finer scrap, comprising practically all that is not bundled. Adjacent to the conveyor is a trap door, through which the material is delivered to the conveyor beneath the platform, whence it is loaded directly into the cars.

The buffer at the end of the spur track has an unusual importance because the rails terminate within a few feet of the second story of a frail tenement house. The company itself built the buffer from a standard design developed by one of the well-known railroads. It is a solid mass of concrete extending 10 ft. into the ground. Even the heaviest of trains could not move it. Incidentally the cost of the buffer was about one-half the price quoted by the local railroad people.

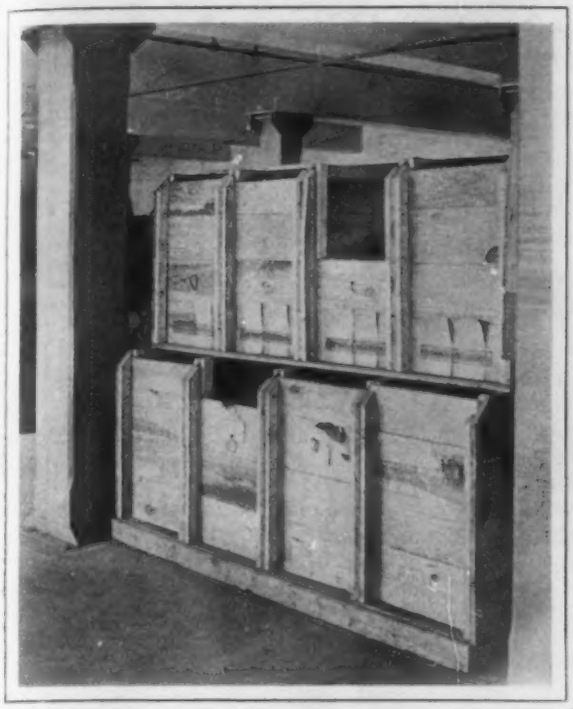
In building the platform the final flooring was omitted until the hard usage incident to the unloading of building materials, machinery, etc., had been completed. As the company will use electric trucks throughout the plant, the advantage of smooth flooring will be accentuated. Concrete runways will be put in, connecting the several buildings, so that materials can be economically transported from either chain department to and from the tumbling, heat treating, hot galvanizing or electroplating buildings. As these runways will terminate at broad entrance ways and the elevator shafts, the transportation problem will be cared for economically. No small element of advantage is the mobility of the shop transportation system.

The factory, as has been stated, contains various examples of ingeniously contrived conveniences, and cheap, homemade substitutions for what would have been more or less costly to purchase in the market. For example, the storage bins are of rough timber. In the basement where the raw material is stored the division between the bins consists of a shoulder high fence, constructed of 3 x 4-in. uprights with heavy plank for the top rail. The bins for finished and semi-finished products are built in sections, each containing several bins. They can be moved if desired and built up by placing one upon another like a sectional bookcase. The construction is most substantial. The bin fronts consist of matched boards which are loose in slots, so that the hight of the front may be regulated to suit conditions. Considered from the standpoint of fire hazard, the use of wood is of small account because of the non-inflammable nature of the contents, and also from the fact that the shop is equipped with an automatic sprinkler system. Wood has the additional advantage, in the opinion of the management, that less noise is created than would be the case with metal striking metal. The method of holding stock cards will be seen in the photograph of a group of bins. The device consists of a short strip of blanked out steel from the scrap pile, which is fastened to the wood by double pointed tacks.

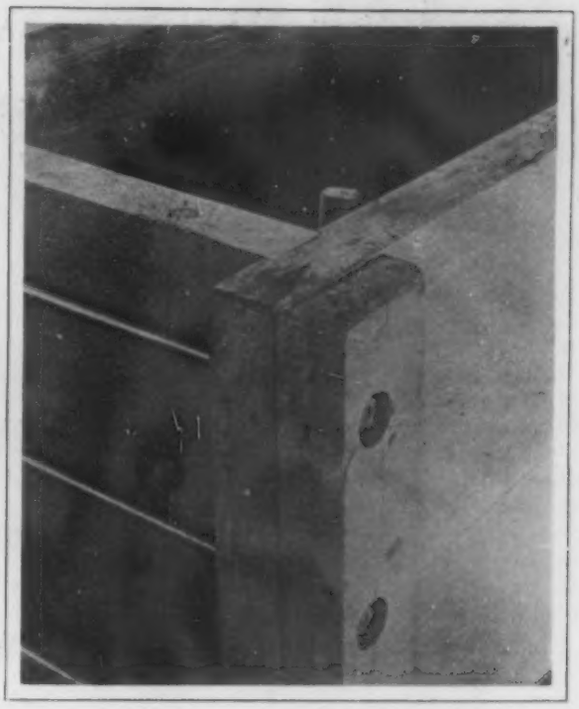
The portable bottomless bins are a novelty well worth the careful study of manufacturers of many classes of product. They are collapsible and occupy little space when not in use. The cost is small. As an illustration shows, the boards of the two sides are held together by substantial strips, which are arranged in pairs at each end to form a groove into which the end boards slip easily. The sides are tied firmly together by chains of the Eureka anti-spreader type manufactured by the company, three at the back and two at the front. Each chain is in two sections, one of which is fastened to each side by a substantial staple. When a bin has been set up the ends of the chains are brought together under the tension exerted by an anti-spreader lock tongue, which acts with cam-like power.



The Collapsible Portable Bins Knocked Down and Erected Ready for Use



Sectional Bins for Finished and Unfinished Product



Corner of Pickling Tank, Giving Details of Construction

The pickling tanks of the galvanizing building were constructed from the company's design. The details are shown in the illustration. The tank is built up of 4-in. cypress timber, two planks being required to give the necessary hight to each side and end. They are dovetailed in a manner which precludes the possibility of leakage. Each is deeply mortised on its edge to permit the introduction of a 2-in. tendon, ¼-in. in width, which is set in white lead. The planks are also held together by heavy bolts. The bolt holes are deeply recessed, permitting the steel to be protected from the deteriorating influence of the acid by wooden plugs.

The sawtooth roof is of approved design. The valleys are broad, permitting easy access for the clearing away of snow or ice or accumulations of dirt. The teeth do not cover the full length and width of the building. No necessity exists for a greater overhead lighting area, the wall windows being broad and high. It is pointed out that in case of fire the accessibility of all parts of a roof may be of great value in combating the flames. The sawtooth roof was built with the puttyless construction furnished by the G. Drouvé Company, Bridgeport, with 1 ft. 6 in. x 3 ft. metal ventilating sash placed two in each 10 ft. bay. In this construction the glass is held between cushions of non-rocking cowhair, the whole being held together with phosphor bronze bolts and nuts which offer a simple means of access for the replacement of broken glass or the repainting of metal parts.

Mackintosh, Hemphill & Co., Pittsburgh, are shipping to the Broken Hill Proprietary Company, New South Wales, Australia, a direct reversing twin-cylinder engine, with cylinders 42 in. diameter by 60-in. stroke, built to drive a 28-in. rail train, now being installed. They are also shipping a 35-in. two-high, reversing blooming mill, complete with tables and manipulator; a motor-driven, gear down-cut shear, capable of cutting steel sections equivalent to 24 in. by 8 in.; also accumulators and spare equipment will make the shipment. The engine is the second of its kind which Mackintosh, Hemphill & Co. have shipped to Australia, the first having been forwarded about a month ago for use in driving the above-mentioned blooming mill.

Awards of Prizes at Safety Exposition

Herewith are given the names of exhibitors in the metal trades and allied lines to whom prizes were awarded at the International Exhibition of Safety and Sanitation which closed at New York December 20. In *The Iron Age* of December 18 was given an outline of what these prize winners displayed.

Grand prize: Edison Storage Battery Company, Orange, N. J.; General Electric Company, Schenectady, N. Y.; National Lamp Works, General Electric Company, Cleveland, Ohio; New Jersey Zinc Company, New York; Norton Company, Worcester, Mass.; United States Steel Corporation, New York; Welin Marine Equipment Company, Long Island City, N. Y.; Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa.

Gold medal: American Abrasive Metals Company, New York; American Mason Safety Tread Company, New York; Benjamin Electric Mfg. Company, New York; Brown & Sharpe Mfg. Company, Providence, R. I.; Corbin Cabinet Lock Company, New Britain, Conn.; Max H. Fisher, 41 Park Row, New York; Julius King Optical Company, New York; F. W. King Optical Company, Cleveland, Ohio; Universal Safety Tread Company, New York; Zeh & Hahnemann Company, Newark, N. J.

Silver medal: Barrett Mfg. Company, New York.

Honorable mention: Allen Mfg. Company, Hartford, Conn., Carboy Inclinator Company, New York; R. P. Smith & Sons Company, Chicago, Ill.

The troublesome question of how to solder aluminum with common solder in a practical way is claimed to have been solved by C. E. Cochrane, Medford, Mass. Samples of his work effecting the union of aluminum with both aluminum and copper show that the solder readily adheres. An intense heat is said not to be required and the claim is made that cooking utensils can be repaired as quickly as galvanized work.

Advanced Welfare Work in Wire Industry

American Steel & Wire Company's Developments at South Works, Worcester—Vital Results of Workmen's Meetings—Landscape Gardening a Safety Factor

BY JOHN NELSON

Some years ago the American Steel & Wire Company made tentative moves toward a system for the betterment of the conditions of its employees. Some of the early work was carried on in the mills at Worcester, Mass., and it is with developments there that the present article deals. Something had already been done at Worcester along this line, but only in the haphazard manner which characterized the benevolent relation of the owner to the employee as it existed a generation ago. The results achieved in the earlier period of the undertaking proved to the management that much good could be accomplished by systematic, painstaking effort. It was demonstrated that a body of workers laboring in a healthful and wholesome environment was vastly more efficient than under conditions that had hitherto been considered wholly adequate. The men who were instrumental in bringing about these changes have not remained satisfied, for each succeeding year has accentuated the value of the system both to the owners and to the workmen themselves.

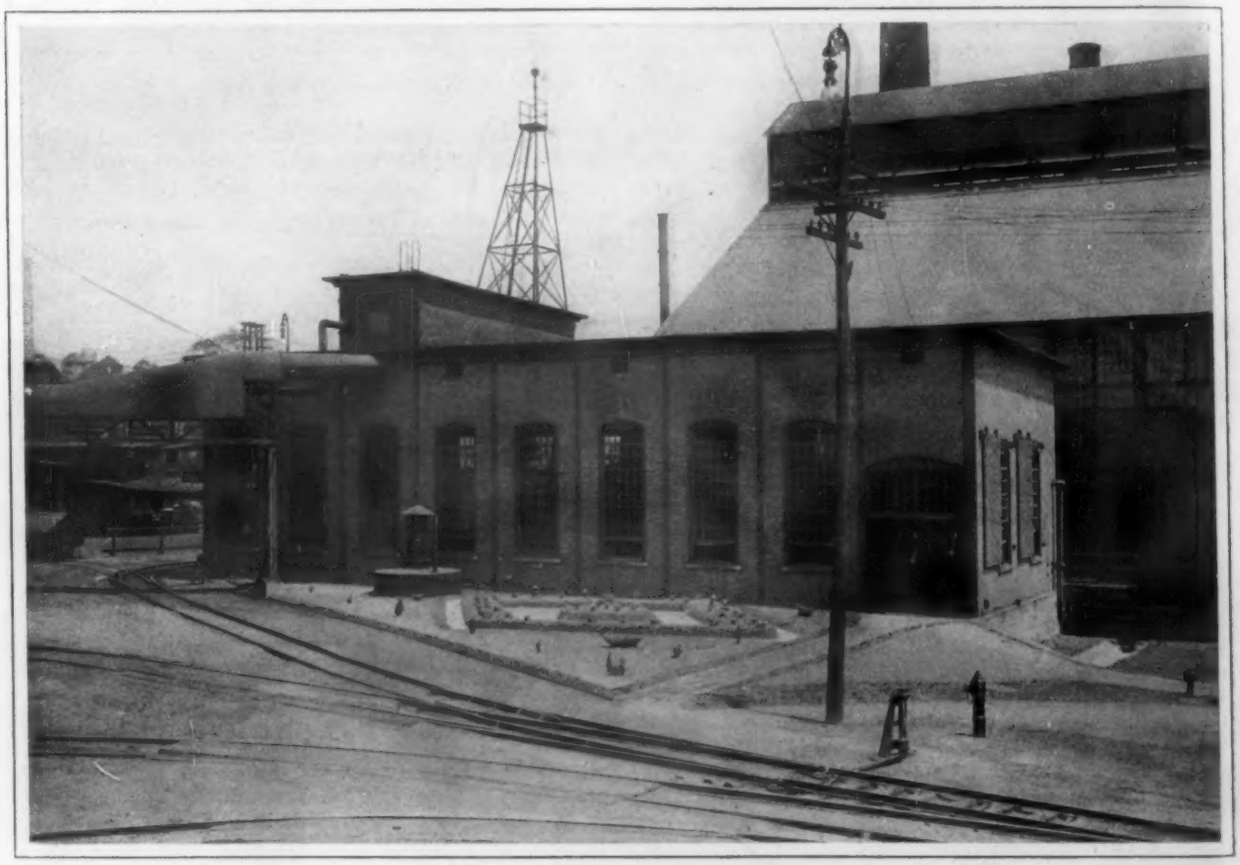


Fig. 1—The Pumping Station, with Grass and Other Landscape Effects

WELFARE FEATURES OF TODAY

The parent company, the United States Steel Corporation, has taken a very active interest in the experiments and has developed practical ideas of its own, and one by one the lessons learned in the combined efforts have been put into practice. The pension system which was inaugurated by the American Steel & Wire Company on January 1, 1902, and made applicable to the employees of all the subsidiary companies of the Steel Corporation on January 1, 1911, by the United States Steel Corporation Pension Fund; the privileges extended to employees to become stockholders in the corporation, making easy payments for their holdings; the workmen's compensation system, which throughout the entire Steel Corporation preceded that created by the State of Massachusetts; the care of injured workmen in hospitals established within the works and by specialists when the nature of injuries demands a skill beyond that of the regular practitioner—all these and other benefits are the outcome of the original united attempts to secure a better relation between employer and workmen. No exception can be taken to the statement that nowhere in America, and doubtless nowhere in the world, are men employed, considering the nature of the labor, under better industrial conditions than those that exist in the plants of the American Steel & Wire Company.

WORKMEN MUST BE CAREFULLY TAUGHT

The study of the various problems involved and the application of the lessons learned go on constantly under a well organized directorship. From a central management the workers who are engaged

Fig. 3—The East Gate and Hose House—the Grass Plot with Its Vase, a Reminder that Orderliness Must Be Maintained

in the task spread out like the spokes of a wheel into every plant and every department. The effort devoted to the safeguarding of employment against accident is conducted with patience and skill. Not the least important feature has been undertaken in the last year or two in the education of men as to the advantages which must result from an adherence to modern ideas of hygiene and general cleanliness, especially in the care of wounds as a precaution against septic poisoning. Another thing which is accomplishing wonderful results is the system of cooperation under which the workmen themselves take an active and interested part in securing safer conditions for their fellows and themselves. Their suggestions have already been prolific of beneficial results.

Those who are familiar with the types of men employed at plants manufacturing steel and its products will understand the thoroughness and persistency with which these lessons must be taught. A very large percentage of the pupils of this great school are men of foreign birth, many of them with such a rudimentary knowledge of the English language that instruction must be given them through interpreters. A great number of them are of nationalities that are steeped in superstition. Century old traditions have to be broken down. Habits of uncleanliness have to be corrected. These things have been accomplished to a degree somewhat difficult of realization to persons who are familiar with the difficulties that are involved.

AN EVOLUTION

Modern industry presents unusual contrasts in the welfare of artisans of all classes, in comparison with the conditions that existed in manufacturing plants not so very many years ago. We are living in a new era of management. The transition is a familiar fact. Fifty years ago factories were small and the employer and his workmen were as a family, in close every-day contact, and their relations were governed by individuality and personality. Thirty years later plants had become so large that owners had got out of touch with their

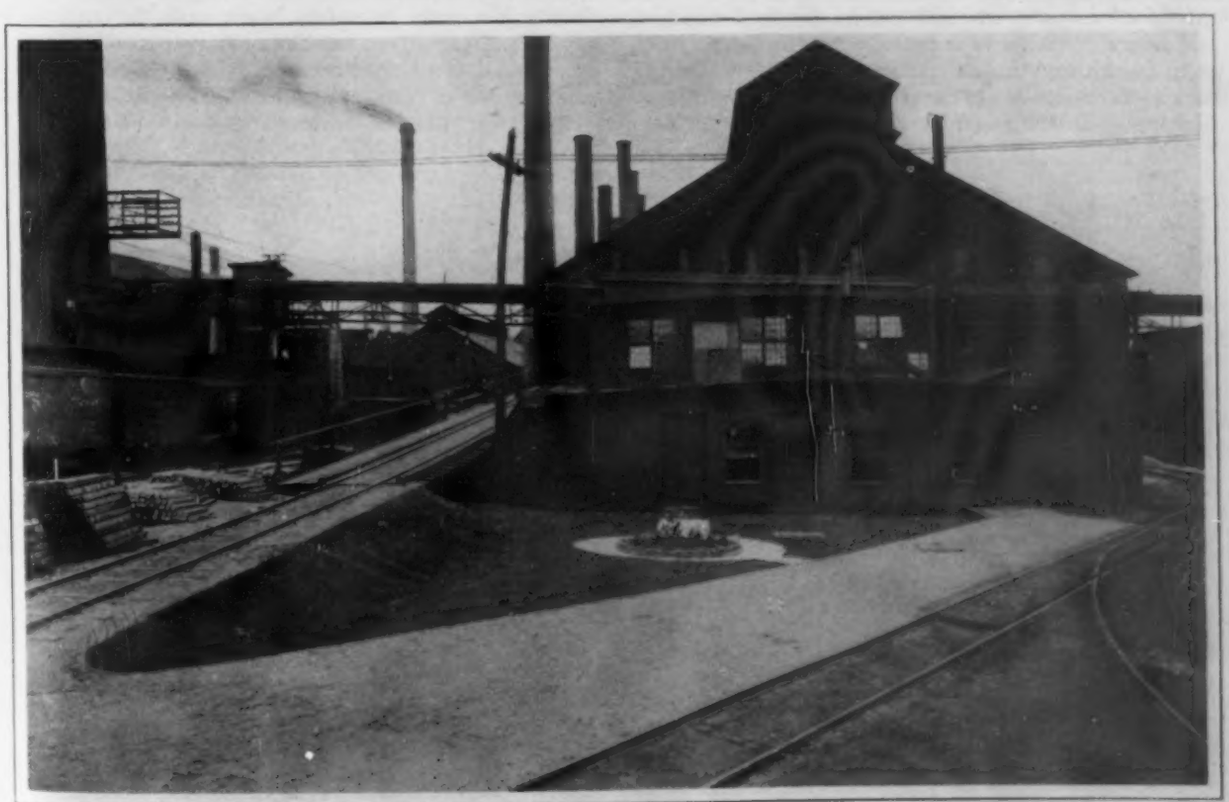


Fig. 2—The North End of the Steel Mill, Where the Lawn Replaces Materials Which Obstructed a View of Trains

people. Managers were confronted with the problems of bigger things, of new types of workers, of labor led by men who had achieved a higher degree of skill in their calling. It stood to reason that antagonism would creep in.

Then the evolution toward improved conditions made its beginning. Owners found that men produced more while they were working, and were absent from their work fewer hours, and were better contented generally, in the ratio of better industrial environment. The incentive to make this influence more nearly universal was begot of two motives, the one to render employment more profitable for the employer, the other to make it more healthful and more lucrative for the workmen. It distributes the benefits equally, as has been shown repeatedly in this case and elsewhere.

Fig. 4—A Dangerous Spot Which Has Been Turfed and Fenced

THE SHOP MEETING

One of the most important factors in connection with the system of accident prevention and the care of injured workmen is the shop meeting as originated at the South Works at Worcester. In the first place the heads of the various departments of the mills meet twice a month at the club house, and various questions of shop management and production are discussed as they arise, and not the least important of these are problems relating to the safety of employees. The superintendent presides and free discussion is encouraged, with no restraint as to speech and mutual criticism. The constant effort is to make these meetings, as well as others, which will be discussed later, as plain spoken as possible. The department heads as a body make inspections of various departments in connection with the meetings, and criticisms of one department by the heads of others are welcomed in the friendliest spirit. The upkeep of safety appliances and the enforcement of operating rules are given careful attention and new ideas are suggested for improvements of all descriptions. Usually circular letters from the general superintendent's office are discussed and the programme is outlined for carrying out such instructions as are contained therein. While the topics considered include everything which has to do with the works, the matter of safety and the well being of the workmen is held to be one of the most important of all. Minutes of the proceedings are prepared for each department, in which, at a meeting with the foremen and sub-foremen the ground is gone over thoroughly, that all may have a complete understanding of what is required. The heads of departments meet at lunch daily, which gives an additional opportunity for suggestion and discussion.

SAFETY CONFERENCES

The foremen's meetings are held every two weeks. Recommendations are considered and complaints heard as to safety work and the enforcement of safety rules, and ideas and suggestions are encouraged from the foremen, who, being in closer touch with the men, are in the best position to determine the value of devices and their adaptability

Fig. 5—The North End of Cable Works, Where the Presence of Obstructions Increased Hazard from Trains

for commercial service. The constant effort is to give emphasis to the fact that all safety rules and requirements must be lived up to. The criticisms by the district safety inspector or works safety inspectors concerning the failure of such enforcement, are generally brought to the attention of the foremen and any negligence is rectified. Minutes of the proceedings of these meetings are recorded and submitted to the superintendent and the permanent safety committee.

The latter body is made up of the assistant superintendent of the plant, and the heads of at least two departments. It passes on all recommendations made by the workmen's safety committee, the works safety inspector, and the district safety inspector. The committee usually views the grounds and examines the machinery and appliances which it is intended to safeguard, and then passes on the suggested ideas, approving or rejecting them according to the consensus of opinion regarding their value. Such as are approved are returned to the works safety inspector who assigns safety numbers to them. File cards are made out and copies are sent to the various officials who are concerned. The permanent safety committee makes periodical inspections of the plant and submits recommendations on its own account. It also passes on all recommendations from the department heads and from the employees' meetings.

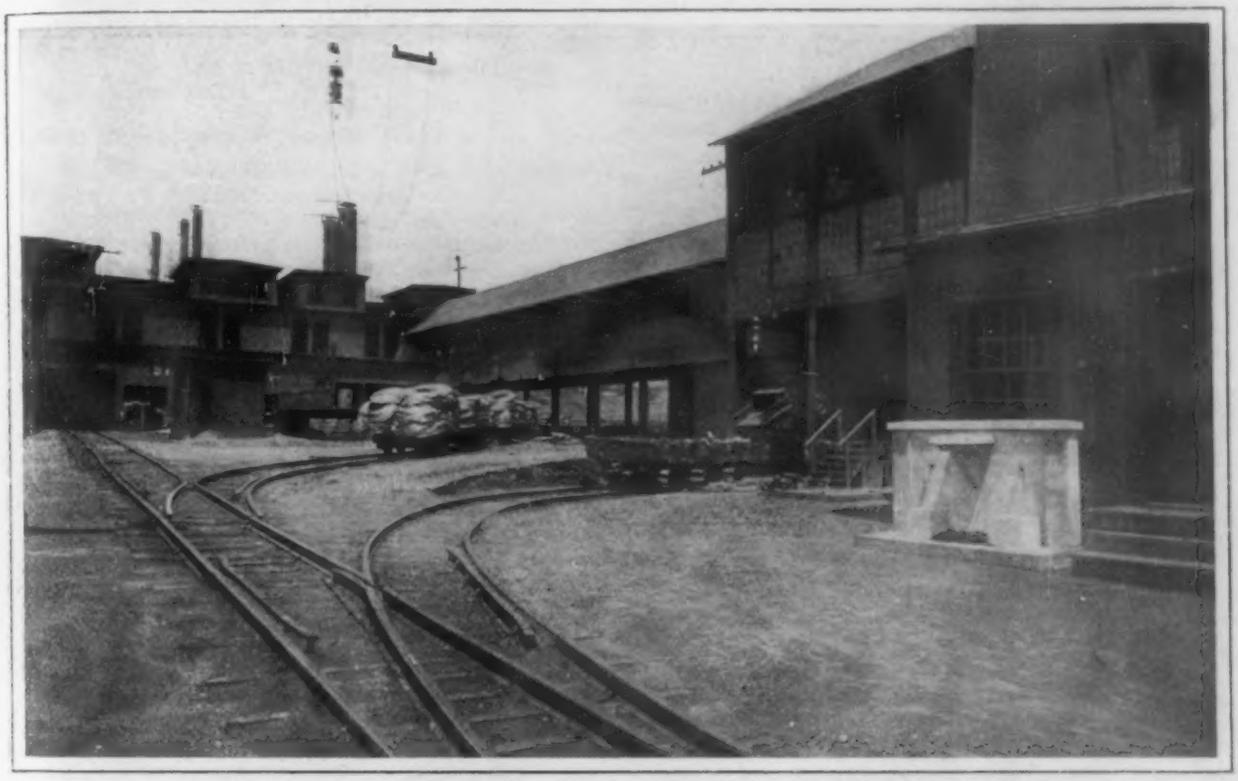


Fig. 6—A Drinking Fountain Which Supplies Artesian Well Water to Large Numbers of Employees Daily

DEPARTMENT EMPLOYEES' MEETINGS

Of all the influences which have to do with increasing the safety of the mills, improving the welfare of injured workmen, and with intensifying efficiency generally, none is more important than the department employees' meetings—perhaps at this later stage of the development none is as important. They are held twice a month, on the company's time. The attendance is confined strictly to the workmen and their foreman. No other person is permitted to be present, excepting such interpreters as may be required. Under no circumstances is the superintendent or the works surgeon or other of the higher officials or foremen of other departments allowed in the room. The intention is to encourage the freest possible discussion among the men, and this is best accomplished, it is believed, when a meeting is confined to a family party. Were the superintendent present workmen might keep silence for fear that their criticism might reflect upon their immediate superior, which, they might argue, would react to their own disadvantage.

The men have learned to trust their foremen, and do not hesitate to register a complaint if they consider that ground for one exists, and they make many suggestions, some of which have proved to be of great importance. Minutes of the meetings go to the superintendent. They contain the names of each workman who has made a suggestion, and every such employee receives recognition in a letter from the superintendent's office to the department head acknowledging the idea and stating frankly whether it is worthy of adoption, and if not the reason why. No man can feel that his suggestion has been forgotten. He knows that it has gone to the highest source of authority in the plant. Also, the author of a successful idea sees his name posted on the meeting records.

RESULTS FROM WORKMEN'S SUGGESTIONS

The results obtained from these meetings have been remarkable. Men who have had no training which would rank them above the unskilled laborer; men employed more because they possess brute strength than because of their intellect, have given the company ideas which have been useful in many cases, and occasionally of very great value. A striking illustration of this was the suggestion of a workman, at a meeting of his department, that something should be done to make easier the lifting of heavy material from the floor to the bench, referring specially to heavy boxes. He pointed out, demonstrating his statement by going through the motion of lifting, that it is easy enough to raise the weight to an arm's length position. The strength-draining strain comes in the additional few inches

Fig. 7—The Fountain at the Rear of the Masons' Building, Replacing an Unsightly Cinder Patch

when the pull is almost entirely from the abdominal muscles. The suggestion was accepted instantly and alterations were made in many benches, lowering them about 4 in. As a result of this change the cases of hernia at the South Works have been greatly reduced. Previous to the adoption of the workman's suggestion, this type of injury had been a serious cause of incapacity and expense, especially in the wire drawing departments, where heavy coils must be lifted to the drawbenches. The desirability of the alteration might not have come to the attention of the management for a long time.

WORKMEN'S REPORTS OF THEIR MEETINGS

A few of the reports of the workmen's meetings are given below, not only to show the nature of the suggestions but the sort of men who make them. The names given in the originals are omitted:

SOUTH WORKS, January 20, 1913.

Mr. J. F. Tinsley, Supt. South Works:

Safety and Accident Meeting, Machine Shop, January 18, 1913.

Meeting called to order at 11:30 A. M. by Mr. C. T. Enberg, foreman. The chairman stated that it was the wish of the company that meetings on safety devices be held in the different departments once a month. The object was to have the men offer suggestions along the line of safety, so that the conditions along these lines could be improved upon and thus reduce the number of accidents. The chairman also impressed on the men the importance of having safety devices in good working order, so that they would really serve the object that they were designed for. He also explained to the men the importance of having injuries attended to at the emergency hospital, no matter how small, they should be attended to there as a large amount of blood poisoning cases have developed lately from neglecting minor injuries.

The following suggestions were offered by the men:

Some sort of a stop was needed on C.'s lathe, so that it could be stopped quickly if necessary. The countershaft on this lathe is a two-speed forward drive and no reverse, so that sometimes when the friction was thrown out it failed to stop. "This is a very common feature with countershafts of this type" and should be remedied in some way.

Alfred —— said that it would be a good thing if some goggles with wire screen around the glasses could be procured for the men to use when they were babbitting bearings, etc.

C. —— said that he thought that some improvement could be made in the babbitting department, as several cases of hernia has developed there lately from heavy lifting of boxes, of weight between 200 and 300 lb. He also thought that the work benches there were too high, making the handling of work unnecessarily hard.*

*The suggestion which revolutionized the hight of benches.

T. J. —— said he thought adjustable light holders were needed at the shop tool grinder, so that the light could be had where best needed. He also thought that adjustable rod holders were needed on the 200-ton portable press, as that would do away with a lot of blocking and make it safer to men to work around this press, it would also save considerable time in rigging up so as to do work there.

Wm. —— said that he noticed the countershaft on the large boring mill was shaking considerably and needed bracing up.

Jeffrey —— said that an extension belt shifter was needed on the 60-in. lathe.

P. J. —— said that the locomotive repair pit should be lengthened about four feet, as it is now it is so short that a man working in the pit could not get out without moving the locomotive one way or the other, unless he crawled out between the driving wheels, and in doing so he was liable to receive bruises and torn clothing.

Meeting adjourned at 11:50 A. M.

J. B. CARROLL, M. M.

SOUTH WORKS, June 28, 1913.

Report of meeting of No. 2 and 3 Rod Gangs held June 27, 1913. Interpreter, C. Mackic; Foreman, John Dobie, Jr.

"Accidents" was the topic for discussion and the chairman endeavored to impress on the men the fact that the matter of accidents was one which all the officials of the company were seriously interested in.

It was noted and the men were congratulated that there had not been an accident to any of the members of the gangs present for six months at least, and the boys thought that they had been doing well, yet it was shown that if they were always careful to see that there was nobody in the way when they were dumping trucks and that the band wires that they take off the trucks of rods were put in a place where they would not be in the way of people passing by they would help to keep others from being hurt.

The danger of walking on tracks and stealing rides on cars was spoken of and the men were instructed not to walk on tracks and to keep off cars.

Time of meeting, 20 minutes.

SOUTH WORKS, April 9, 1913.

Meeting of No. 1 Shearmen, Day Turn, Maurice Powers, Chairman. Prevention of Accidents and Cleanliness.

Meeting held from 11:25 A. M. to 11:50 A. M., Wednesday, April 9th, at the No. 1 shear shanty. The men understand and speak English speak pretty well and our meeting went along quite smoothly.

One way that Joe —— (a Pole) says an accident may be avoided at the shears would be to set aside any piece too large or crooked and have it scored and broken at the drop. I assured Joe that his idea was very good and right, and that is what I want to have done.

Joe —— (a Polander) says that a great many times while shearing hard rails the splinters will fly, and he has known the shearmen to be injured about the face and head a great many times this way. This is very dangerous, especially on nights when it is impossible to see these splinters.

I think that a pair of goggles or a mask would be one way in which to avoid an accident of this nature, and I would suggest that they be given a test.

At present the first shearman at No. 1 shears is protected by an overhead screen, to prevent any rails from flying up over the guard rails and coming down on his head. John —— suggests that this screen be extended back three or four feet so as to give protection to the second man as well as the first one.

Joe —— would like to have the gear cover put back on No. 1 shears. This will save both the men and the machine. A great many times, while shearing rails, they fly around and with this cover on it may keep any of the flying pieces from getting into the gears.

With reference to the above, the gear cover has been off for some time and I find that it cannot be put on again until the screen protector is arranged different.

As regards to cleanliness both men say they can do

a whole lot more towards keeping the shanty cleaner and the machinery wiped up.

I find that an oil pan can be used to very good advantage under the motor at No. 1 shears and in this way keep a lot of oil off the floor. This will give the place a little better appearance.

At present there is an accumulation of dirt under the shear stand which falls off of the rails as they are being sheared. As the weather warms up this will loosen out and we will have it loaded up and sent to the dump.

PROMPT SURGICAL ATTENTION

A most essential element in the conduct of these meetings is the opportunity afforded to educate men as to the great advantage of immediate surgical attention, no matter how trivial the injury may be, and the carrying out of the surgeon's orders until the wound has healed. The company, in caring for its employees free of charge, at the hospital on the premises, or at the man's home, does not limit such care to the first 14 days following the injury, during which the law requires free care, but it provides emergency hospital and surgical treatment at home or at the plant as long as disability exists. Septic poisoning is the bane of all manufacturing plants, and in steel and wire mills cuts and burns and abrasions are common, even under the best working conditions, and "blood poisoning" is correspondingly prevalent. The custom had been for the men to neglect these wounds. Before this campaign of education was instituted an employee who had scratched his body on a piece of rusty wire, or had sustained a cut, the flow of blood from which he could staunch himself, would never have thought of having the injury treated at the company's hospital. Even had the wound become troublesome he would have depended upon home remedies, which in a great majority of cases possess no medical value. A short time ago had a wire drawer or other workman at the South Works gone to the hospital with a scratch or cut, or bruise or burn, unless it were really serious, he would have been jeered at by his comrades; and the average man is afraid of such taunts.

PREVENTION OF SEPTIC POISONING

At the workmen's meetings the foreman talks very seriously about the vast difference to an injured man between septic treatment of injuries and the lack of it. The lesson is emphasized time and time again, and in a practical way. For illustration, two men who had each lost a part of a hand by septic poisoning were brought into the meetings and made to hold up the maimed members while it was pointed out to the assembled men that these results came not from any serious injury in the beginning, but from the neglect of trivial wounds. Where workmen cannot speak English, the discussion and the conclusions arrived at are translated for the various nationalities.

The proof of the value of these meetings rests in the record of the South Works hospital. In the last quarter of 1912 there were 17 cases of septic poisoning from one department alone. In the first quarter of 1913 there were 18 cases from the same body of men. In the quarter ending July 1, 1913, the only case of septic poisoning reported in all the works, employing several thousand men, was that of a man in a packing room who failed to live up to the directions of the surgeon.

As the result of the familiarity of the men with the advantages of scientifically correct treatment the total number of accidents entered upon the records has increased in a large way, but the number of serious consequence from accidents has decreased very considerably. The number of idle hours has gone down until the percentage of the grand total is very small.

Fig. 8—The Lawn at an End of the Cable Works

PREVENTION OF HEAT PROSTRATION

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At the South Works at Worcester the company has carried out the idea of employing landscape gardening as a means of obtaining greater safety to workmen; of reducing depreciation of equipment from dust and grit; and of improving hygienic conditions generally. Seldom if ever have lawns been created to serve so utilitarian a purpose. As in most steel and wire mills the yard is a constant menace to employees. The South Works constitutes the largest individual plant of the American Steel & Wire Company. More than 3,000 workmen are employed. In working hours men are continually passing through the yard, crossing railroad tracks over which the narrow gauge trains of the mill system and the trains from the trunk railroad pass at frequent intervals. In fact, the tracks constitute a veritable network, and, as material is conveyed from one department to another, much switching is required. Familiarity breeds contempt in the presence of a danger of this character and the men are accustomed to take unnecessary chances. The plant is the development of many years. Its buildings are laid out somewhat irregularly and there are dangerous corners where a quick

Fig. 7—The Fountain at the Rear of the Masons' Building, Replacing an Unsightly Cinder Patch

when the pull is almost entirely from the abdominal muscles. The suggestion was accepted instantly and alterations were made in many benches, lowering them about 4 in. As a result of this change the cases of hernia at the South Works have been greatly reduced. Previous to the adoption of the workman's suggestion, this type of injury had been a serious cause of incapacity and expense, especially in the wire drawing departments, where heavy coils must be lifted to the drawbenches. The desirability of the alteration might not have come to the attention of the management for a long time.

WORKMEN'S REPORTS OF THEIR MEETINGS

A few of the reports of the workmen's meetings are given below, not only to show the nature of the suggestions but the sort of men who make them. The names given in the originals are omitted:

SOUTH WORKS, January 20, 1913.

Mr. J. F. Tinsley, Supt. South Works:

Safety and Accident Meeting, Machine Shop, January 18, 1913.

Meeting called to order at 11:30 A. M. by Mr. C. T. Enberg, foreman. The chairman stated that it was the wish of the company that meetings on safety devices be held in the different departments once a month. The object was to have the men offer suggestions along the line of safety, so that the conditions along these lines could be improved upon and thus reduce the number of accidents. The chairman also impressed on the men the importance of having safety devices in good working order, so that they would really serve the object that they were designed for. He also explained to the men the importance of having injuries attended to at the emergency hospital, no matter how small, they should be attended to there as a large amount of blood poisoning cases have developed lately from neglecting minor injuries.

The following suggestions were offered by the men:

Some sort of a stop was needed on C.'s lathe, so that it could be stopped quickly if necessary. The countershaft on this lathe is a two-speed forward drive and no reverse, so that sometimes when the friction was thrown out it failed to stop. "This is a very common feature with countershafts of this type" and should be remedied in some way.

Alfred —— said that it would be a good thing if some goggles with wire screen around the glasses could be procured for the men to use when they were babbitting bearings, etc.

C. —— said that he thought that some improvement could be made in the babbitting department, as several cases of hernia has developed there lately from heavy lifting of boxes, of weight between 200 and 300 lb. He also thought that the work benches there were too high, making the handling of work unnecessarily hard.*

*The suggestion which revolutionized the hight of benches.

T. J. —— said he thought adjustable light holders were needed at the shop tool grinder, so that the light could be had where best needed. He also thought that adjustable rod holders were needed on the 200-ton portable press, as that would do away with a lot of blocking and make it safer to men to work around this press, it would also save considerable time in rigging up so as to do work there.

Wm. —— said that he noticed the countershaft on the large boring mill was shaking considerably and needed bracing up.

Jeffrey —— said that an extension belt shifter was needed on the 60-in. lathe.

P. J. —— said that the locomotive repair pit should be lengthened about four feet, as it is now it is so short that a man working in the pit could not get out without moving the locomotive one way or the other, unless he crawled out between the driving wheels, and in doing so he was liable to receive bruises and torn clothing.

Meeting adjourned at 11:50 A. M.

J. B. CARROLL, M. M.

SOUTH WORKS, June 28, 1913.

Report of meeting of No. 2 and 3 Rod Gangs held June 27, 1913. Interpreter, C. Mackie; Foreman, John Dobie, Jr.

"Accidents" was the topic for discussion and the chairman endeavored to impress on the men the fact that the matter of accidents was one which all the officials of the company were seriously interested in.

It was noted and the men were congratulated that there had not been an accident to any of the members of the gangs present for six months at least, and the boys thought that they had been doing well, yet it was shown that if they were always careful to see that there was nobody in the way when they were dumping trucks and that the band wires that they take off the trucks of rods were put in a place where they would not be in the way of people passing by they would help to keep others from being hurt.

The danger of walking on tracks and stealing rides on cars was spoken of and the men were instructed not to walk on tracks and to keep off cars.

Time of meeting, 20 minutes.

SOUTH WORKS, April 9, 1913.

Meeting of No. 1 Shearmen, Day Turn, Maurice Powers, Chairman. Prevention of Accidents and Cleanliness.

Meeting held from 11:25 A. M. to 11:50 A. M., Wednesday, April 9th, at the No. 1 shear shanty. The men understand and speak English speak pretty well and our meeting went along quite smoothly.

One way that Joe —— (a Pole) says an accident may be avoided at the shears would be to set aside any piece too large or crooked and have it scored and broken at the drop. I assured Joe that his idea was very good and right, and that is what I want to have done.

Joe —— (a Polander) says that a great many times while shearing hard rails the splinters will fly, and he has known the shearmen to be injured about the face and head a great many times this way. This is very dangerous, especially on nights when it is impossible to see these splinters.

I think that a pair of goggles or a mask would be one way in which to avoid an accident of this nature, and I would suggest that they be given a test.

At present the first shearman at No. 1 shears is protected by an overhead screen, to prevent any rails from flying up over the guard rails and coming down on his head. John —— suggests that this screen be extended back three or four feet so as to give protection to the second man as well as the first one.

Joe —— would like to have the gear cover put back on No. 1 shears. This will save both the men and the machine. A great many times, while shearing rails, they fly around and with this cover on it may keep any of the flying pieces from getting into the gears.

With reference to the above, the gear cover has been off for some time and I find that it cannot be put on again until the screen protector is arranged different.

As regards to cleanliness both men say they can do

a whole lot more towards keeping the shanty cleaner and the machinery wiped up.

I find that an oil pan can be used to very good advantage under the motor at No. 1 shears and in this way keep a lot of oil off the floor. This will give the place a little better appearance.

At present there is an accumulation of dirt under the shear stand which falls off of the rails as they are being sheared. As the weather warms up this will loosen out and we will have it loaded up and sent to the dump.

PROMPT SURGICAL ATTENTION

A most essential element in the conduct of these meetings is the opportunity afforded to educate men as to the great advantage of immediate surgical attention, no matter how trivial the injury may be, and the carrying out of the surgeon's orders until the wound has healed. The company, in caring for its employees free of charge, at the hospital on the premises, or at the man's home, does not limit such care to the first 14 days following the injury, during which the law requires free care, but it provides emergency hospital and surgical treatment at home or at the plant as long as disability exists. Septic poisoning is the bane of all manufacturing plants, and in steel and wire mills cuts and burns and abrasions are common, even under the best working conditions, and "blood poisoning" is correspondingly prevalent. The custom had been for the men to neglect these wounds. Before this campaign of education was instituted an employee who had scratched his body on a piece of rusty wire, or had sustained a cut, the flow of blood from which he could staunch himself, would never have thought of having the injury treated at the company's hospital. Even had the wound become troublesome he would have depended upon home remedies, which in a great majority of cases possess no medical value. A short time ago had a wire drawer or other workman at the South Works gone to the hospital with a scratch or cut, or bruise or burn, unless it were really serious, he would have been jeered at by his comrades; and the average man is afraid of such taunts.

PREVENTION OF SEPTIC POISONING

At the workmen's meetings the foreman talks very seriously about the vast difference to an injured man between septic treatment of injuries and the lack of it. The lesson is emphasized time and time again, and in a practical way. For illustration, two men who had each lost a part of a hand by septic poisoning were brought into the meetings and made to hold up the maimed members while it was pointed out to the assembled men that these results came not from any serious injury in the beginning, but from the neglect of trivial wounds. Where workmen cannot speak English, the discussion and the conclusions arrived at are translated for the various nationalities.

The proof of the value of these meetings rests in the record of the South Works hospital. In the last quarter of 1912 there were 17 cases of septic poisoning from one department alone. In the first quarter of 1913 there were 18 cases from the same body of men. In the quarter ending July 1, 1913, the only case of septic poisoning reported in all the works, employing several thousand men, was that of a man in a packing room who failed to live up to the directions of the surgeon.

As the result of the familiarity of the men with the advantages of scientifically correct treatment the total number of accidents entered upon the records has increased in a large way, but the number of serious consequence from accidents has decreased very considerably. The number of idle hours has gone down until the percentage of the grand total is very small.

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view of approaching trains cannot always be obtained. Formerly the yards were not so well kept —the conditions were those common in a majority of steel works. Spaces which were not required for the storage of material, or otherwise used in the routine of manufacturing, were piled with materials that naturally obstructed the view, and other open areas sometimes served as a dumping ground for odds and ends and as a consequence became factors in the general hazard. Generally speaking, nothing in this condition interfered much with the economy of production. It was simply the usual practice in a very busy plant where the constant effort is to procure a maximum of output, with everybody working at high tension.

John F. Tinsley, the superintendent of the South Works, conceived the idea of a permanent condition of extreme orderliness in the yard. His principal purpose was to make the outdoor spaces of the plant as safe as possible, following out the plan which had been developed so completely within the buildings. The records of the works prove that a prolific source of accident was about the railroad tracks. In order to assist in securing an easy and permanent maintenance of orderliness grass plots were put in at places where they would have the dual function of preserving tidiness, and of permitting full observation of impending danger. The changes were carried out at small expense.

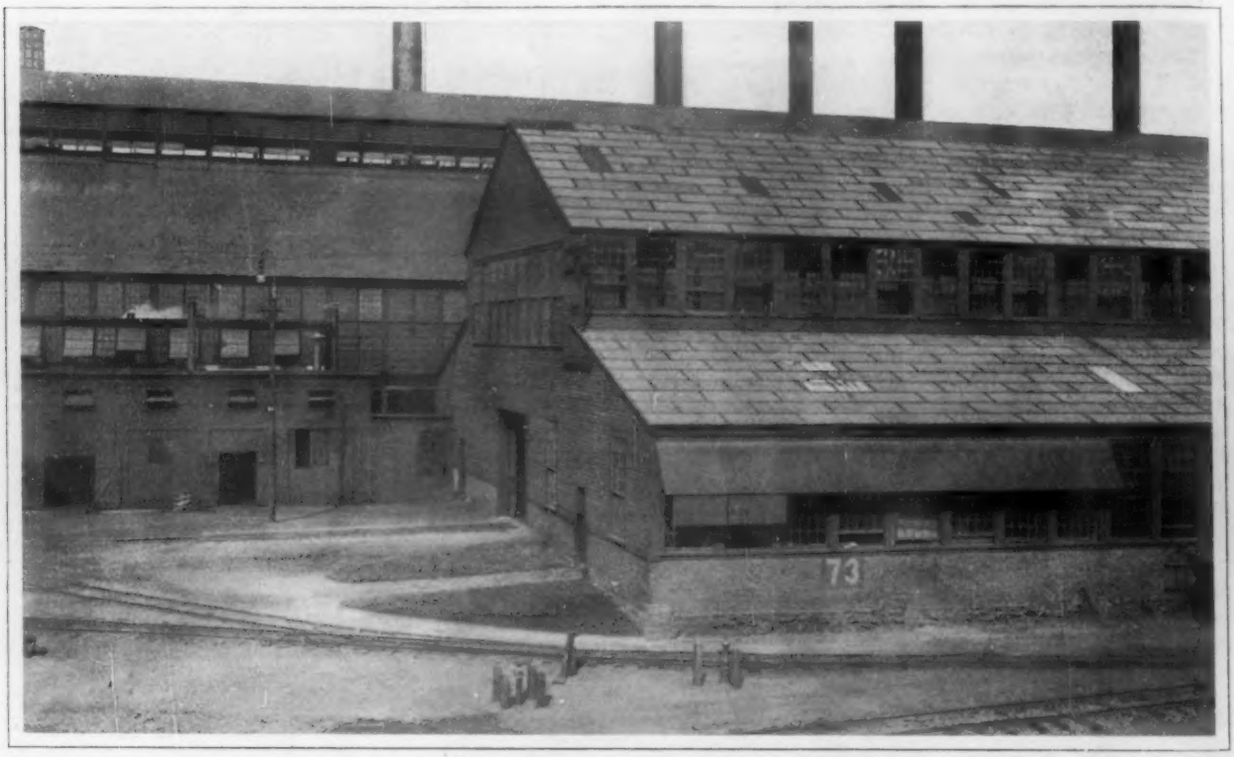

Fig. 9—Entrance to Machine Shop, Where Lawn Serves to Prevent Short Cuts Across the Dangerous Track

SOME EXAMPLES

In Fig. 1 the pumping station is seen where is housed a Snow pumping engine having a capacity of 10,000,000 gal. a day. The space now occupied by the lawn was formerly a dusty expanse from which the prevailing winds of summer carried grit to the exposed mechanisms. It is now a most sightly spot, restful to the eye. At the north end of the steel mill a clearing was made to give a good view of approaching trains. An attractive bit of grass is a constant preventive against the renewal of the old conditions. The risk of accident from the trains is greatly reduced. The hose house, in which is kept a part of the apparatus used by the company's private fire department, is close to one of the main entrances to the works, as will be seen in Fig. 3. This used to be an unsightly spot which it was desirable to clean up and to keep open. The ornamental grass plot emphasizes the company's requirement that no litter of any sort should be permitted to remain in the vicinity. The open space is needed in order that employees may have a free entrance to and from the gate, and also that the fire department shall not be interfered with in any way in starting the apparatus on its way to the point of danger.

Another spot was the entrance to the cable works, Fig. 4. It will be noted that the sharply sloping bank has been covered with turf, while a fence separates it from the railroad tracks. The open space at the north end of the cable plant formerly presented a very different picture from that in the illustration. At this point are greater possibilities of accident than in any other area about the works. The ingot cars are seen as they are leaving the steel plant. Over these tracks also pass the heavy trains from the trunk line, loaded with coal and materials for the steel plant. The grade is sharp and trains must travel at high speed in order to maintain their momentum. Serious accidents occurred here, usually because of conditions which no longer prevail. The tracks and their neighborhood are so free from any sort of rubbish or material that the accidental presence of anything that may have dropped from a car or left by a careless workman is quickly observed and removed. The drinking fountain seen in another picture exists not only to provide water to employees passing through the yard but to emphasize the fact that the space surrounding it must be kept clear.

GRASS PLOTS INSURE SAFETY

The entrance to the machine shop furnishes a striking example of the advantages of landscape gardening as a protection against hazard. The

track passes close to the corner of the building on a curve. A man leaving the shop and making the natural short cut across the yard has no vision of an approaching train until he has practically stepped upon the track. The grass plots are a warning that he shape his course at a safer angle. He must not pass across the lawns; apparently there is no temptation for him to do so. The greensward is a much more important hindrance than a fence, the vaulting of which would be undoubtedly a very common occurrence, and were a train about to pass the corner the leap would probably mean serious injury or death. Also a fence so very close to the track would be a source of danger from the railroad side. The fountain at the rear of the masons' building, serving the same purpose as the other beauty spots, is a good example of the enthusiasm with which the several departments entered into this work. The superintendent confined and entrusted the carrying out of his ideas to individual departments. Each was permitted to have its share in the design of the grounds adjacent to it. In the case in question the boss mason requested the privilege of designing and building the fountain, and he did his work exceedingly well. Personal interest in the work on the part of employees has shown itself in many ways. The management is determined to confine the beautifying of the yard to an essentially practical basis. The workmen, according to their suggested ideas, would make of the place a veritable park. Men have even gone to the point of offering to furnish flowering plants from their own garden in order to improve the appearance of the property from an æsthetic point of view. This sort of cooperation cannot help but be an additional influence toward loyalty.

Fig. 10—General View in Yard, Showing the Scope of the Effort to Secure Orderliness and Increasing Safety from Accidents

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The Eagle Metal & Supply Company, 29 Howard street, New York City, has decided to change its name, and, having taken the necessary steps, will hereafter transact business under the name of Eagle Pipe Supply Company, Inc.

Extensive Crane Co. Construction

The most important and the largest new foundry construction now under way in the Chicago district is the building of the Crane Company plant, which will consolidate into one group the several foundries now operating in scattered locations. The limited areas available for plant building in the down-town district in which the original Crane Company plants were built, made it necessary that the plant growth be taken care of in isolated units. The move to remedy this disadvantage was brought to a head by the acquisition of much of the property upon which the Crane plants were built, by the Pennsylvania and other railroads for terminal purposes. A site of 160 acres was then secured in the district fronting on Kedzie avenue, between Thirty-ninth and Archer avenues. The plans were outlined for a plant, the cost of which will approximate $5,000,000 in the near future. Contracts have been let for the first of these buildings. The plans provide for a central office building flanked on either side by foundry and manufacturing buildings arranged in two rows of parallel units. The office building will be four stories, the others two stories. The plant arrangement contemplates the receiving of raw materials at the far ends of the two rows of buildings, from these points moving through the processes of manufacture toward the center into a common storage and shipping building. Present plans call for 20 buildings, each of which will be 100 x 500 ft. in size.

The Clipper Belt Lacer Company, Grand Rapids, Mich., has just completed an addition to its plant, which doubles the productive capacity.

A Stassano electric furnace, the second to be installed in the United States, has been put in operation in the plant of the Hess Steel Castings Company, Bridgeton, N. J.

Bonus System in Training Apprentices

Rearing the Mechanic in an Atmosphere of Efficiency—The Stimulus of Higher Pay for Greater Production

BY JOHN NELSON

One of the really important advances that have been made in the training of boys for the mechanics' trades is the application of the bonus or premium system to their employment. In addition to the usual guaranteed wage, which increases with length of service, they are paid for the time saved from a fixed standard, the basis being the same as that which applies to the journeymen.

In working under bonus the apprentice is given an educational advantage of very great importance. In the first place, he becomes intimately familiar with a system that is having an increasingly powerful influence in solving the difficulties between employers and employees. He learns that only by greater efficiency of production can a bonus be earned, and naturally he becomes a student of those problems the solution of which means money gained by the workmen, including himself, as well as by the owner. He is taught not only how to operate machinery, but also to strive for the greatest possible results in quantity of production that can be achieved without lowering the standard of the product. The stimulus of increased earnings is added to whatever native ambition he may possess. He acquires two of the rarest of gifts among mechanics, the power to estimate the time which work should require and the knowledge of what costs actually are. It is readily seen that in the after industrial career of one educated in these details his usefulness should be far greater than if he had been trained according to the usual practices embodied in an apprentice course.

The bonus system as applied to the training of boys is in successful operation in an American plant which manufactures high-class machinery and employs some 200 men in the machine shop and foundry. The general manufacturing system is highly efficient. A great deal of intelligent study has been given to methods of production. A bonus system has been in effect for several years, gradually extending in its scope until a large percentage of the productive hours now come under its workings.

A standard time is fixed, in which a given operation or group of operations should be accomplished. The workman receives a given wage per hour for his working time whether or not he performs a task within the prescribed limit. In addition he gets full pay at his own wage rate for all time saved from the standard. The results have been highly satisfactory to the employees as well as to the owners. Probably no exaggeration exists in

Name No. 160
Wage Record From 7/1/13 To
Rate per hour .11½ Hours per full week 54

Week	Hours In	Hours Out	Wage	Bonus	Total
7 2	4½	1½	4 55	4 68	9 23
7 10	1836		2 00	11	2 11
7 17	50	4	5 50		5 50
7 24	50	4	5 50	3 56	9 11
7 31	50	4	5 50	4 06	9 61
8 7	50	4	5 50	01	5 63
8 14	50	4	5 50	70	6 25
8 21	50	4	5 50	1 03	6 63
8 28	46	8	5 10	44	5 54
9 4	4½	1½	4 55		4 55
9 11	50	4	5 50	96¢	15 19
9 18	54		6 00	87	6 87
9 25	54		6 00		6 00
10 2	54		6 00	1 44	7 44
10 9	54		6 00	1 40	7 40
10 16	36	18	4 00	1 99	5 99
10 23	54		6 00	7 36	13 36
10 30	54		6 00		6 00
11 6	54		6 00	1 50	7 50

Name No. 133
Wage Record From 7/1 1913 To
Rate per hour .25 Hours per full week 54

Week	Hours In	Hours Out	Wage	Bonus	Total
7 2	47½	1½	10 25	13	10 38
7 10	45	9	11 25	13	11 38
7 17	47½	1½	10 20		10 20
7 24	50	4	12 50	75	13 25
7 31	48	6	12 00		12 00
8 7	50	4	12 50	8 38	20 88
8 14	13	41	3 25		3 25
8 21		54			
8 28		54			
9 4		54			
9 11	22	32	5 50	88	6 38
9 18	59		14 75	6 07	20 82
9 25	53	1	13 25		13 25
10 2	54		13 50	2 51	16 01
10 9	53	1	13 25	64	13 94
10 16	50½	1½	13 10	44	13 54
10 23	54		13 50		13 50
10 30	54		13 50	3 07	16 57
11 6	54		13 50	3 94	17 44

Fig. 1—Records of Two Apprentices Demonstrating the Added Earning Power Afforded Them by the Bonus System

Form 35

Name of Part Lever Quantity 35 Material C.R. Drawing No. 785 Part No. 785

Order 31479 Job 1 Hrs. M. Ea. Est. by H.C.T. Date 5/6/12

OPERATION	No.	MACHINE	TOOLS	Time Allowed	Rate	Estimated Labor Cost	WORKMAN	Clk. No.	Rate	Actual Time	BONUS Hrs.	BONUS Amount	LOSS Hrs.	LOSS Amount
Chuck, face, turn complete	1	Lathe	Reg	9½	27½	2 64	Brown	133	22½	9	½	11		
Millends	2	Milling	Fixture	4¼	30	1 28	Smith	170	25	3	1¼	31		
Drill, ream, countersink & Tap	3	Drill	Jig	5¼	25	1 31	Jones	130	19½	4	1¼	24		
Chip oil groove & burr	4	—	—	3	25	75	Hill	121	19½	2½	½	10		

Material C.R. Dept. 1 Date ordered 5/6/12 Date delivered 5/13/12

Fig. 2—The Record Card Which Contains the Standard Time, and Other Results of Planning and the Outcome of the Workmen's Efforts to Earn a Bonus

the statement that the machinery in these works has probably doubled its production wherever it has been operated under bonus. For sake of illustration, a group of operations with a drilling machine had been averaging 9 hr. for each piece. A study of the job convinced the management that a great waste of time was being made. With full allowance for actual machine operation and for setting up work and other preliminary labor, including the removal of completed work, 4 hr. was deemed to be sufficient. When the operator was consulted concerning this estimate, he expressed vigorously his belief that it was an impossibility. After a beginning in which he was unsuccessful, largely through half-hearted effort, he reduced the time to 3 hr. His wage was 25c. per hr. He was paid for the 3 hr. of actual working time plus 1 hr. of bonus, that is to say, $1 instead of 75c. for 3 hr. The company saved the difference between $2.25 for 9 hr., which it had been costing, and $1 for 3 hr. plus a bonus given the foreman, which will be referred to later in the article. A still greater economy resulted in overhead. The machine's production was trebled and the general items of burden distributed over a much larger product. Such experiences come directly into the routine existence of the apprentice.

The apprentice rates in this shop are 11 1/9c. per hr. ($1 per day) for the first year, 15c. for the second year, 18c. for the third and 25c. for the fourth. The wage may be advanced at more frequent intervals in instances of unusual aptitude on the part of the boy. In any case, the apprentice may be sure of the regular schedule if he has sufficient promise to make it worth while to retain him on the payroll. Incidentally, this company does not indenture its apprentices. The contract is no more binding than that between the corporation and a journeyman.

The two cards, Fig. 1, give some idea of how the bonus system works out in its relation to the earning power of apprentices. That at the left contains the record of a first-year boy by weeks for some months, that at the right the record of a fourth-year boy. The correction should be made that the apprentice is not on bonus work all of the time. His course comprises all kinds of modern machine shop training and to put all tasks on bonus has not been found practicable. Yet the 11 1/9c. boy earned more than $2 average bonus a week in the 19 weeks recorded and nearly 38 per cent. was added to his regular wages. The older boy's extra earnings amounted to 15 per cent. of his regular wages. Less of his time was on bonus work. The stimulus is a material one, not merely nominal.

Each part of every machine to be built is laid out carefully as to details of operation before the order for manufacturing goes into the works. The card, Fig. 2, is filled in with all information and instructions. On it are the part name and number, the quantity, material, drawing number and the order and job numbers. Each operation is listed by number denoting the required sequence. In the next columns are given the machine and tools, and the estimated time and the standard wage rate, together with the total labor cost. The columns at the right of the card are filled in when the record is received at the office at the completion of each operation.

The time allowed is determined after careful study of previous records under daily wage production, if such records exist, and from knowledge of the operations involved. Tables of time consumed to remove metal under different cuts and speeds constitute a very valuable assistance in this line of planning. In almost every case the estimate is far below what has been done under the daily wage system. And almost never has the reduction been so great that bonus was not earned.

To study an individual case, in operation 1 on the card the time allowed for the lathe work on 35 levers is 9½ hr. The standard rate of wages is 27 7/9c., or $2.50 for a 9-hr. day, making a total standard labor cost of $2.64. The employee's bonus is not influenced by the standard wage rate or the standard cost. His has to do only with the standard time. The foreman received a bonus based

not only on the time saved, but on the net productive labor cost saved. One cent goes to him for every hour saved in time, and he gets one-half the money saved from the standard cost.

Referring to Fig. 1, Brown, a 22c. man, does the work in 9 hr. and saves ½ hr. The saving from the estimated labor cost is 66c., of which the foreman gets 33c., in addition to the ½c. for the time. The purpose of this dual bonus is to stimulate the foreman not only to save time, but to take a deeper interest in the low wage man. Were a shop force made up entirely of high-class mechanics the one bonus of so much for each hour saved from the standard might be sufficient, for the saving of time and labor cost would go along with consistent evenness. Nowadays, however, it is practically impossible to procure such a working force, if it is desired to do so. Therefore, the foreman should strive to improve the efficiency of the low efficiency men, and these include the apprentices. He must work harder, must use his brain to better advantage, to make for himself a greater premium from a 20c. than a 30c. man. He must give more careful instructions and watch the progress of each task with deeper and more constant scrutiny. He knows that the work must be up to a standard of quality if it is to pass the inspection which is a check upon the bonus. He becomes a greater factor in production. His men receive an invaluable training. And the influence of the effort has a strong moral effect upon the highly skilled mechanic. The 40c. man cannot afford to permit the 20c. man or the apprentice to equal his own production, and he works the harder in consequence.

To return to the establishment of standard time, once fixed it is never reduced, no matter what the circumstances, until methods or equipment are improved, and in such cases the workman is consulted in order that he may feel himself fairly treated. If the time allowed is too great and the workman's bonus is correspondingly high the resulting advantage to him is permitted to remain. The company has always in mind the fact that the work is being accomplished in less time than under the hourly wage system formerly in practice. Consequently, the overhead cost is decreased. To suppose a case, which those who have used the bonus system will not think at all exaggerated, a piece of work that formerly required 10 hr. to perform on an average was given a standard time of 5 hr. and the workman reduced the time to 2 hr. He earned a bonus of 3 hr. and the company paid him his wage for 5 hr. The actual saving in wages to the owner was the difference between the former 10 hr. and the 5 hr. and foreman's bonus and the machine was in use 2 hr. instead of 10 hr. The production of a plant can grow in a large way under such conditions as these before additional equipment is needed.

Form No. 22.
Order No. 31479 Date 5/6/12
Part No. 785 No. Wanted 35
Drawing No. 785 No. Fin'd
Job No. 1 Op. No. 1 Time 9½
Chuck, face & turn complete
Date Completed Foreman 1
DELIVER TO DEP'T. 2

Fig. 3—The Work Ticket Which Informs a Workman the Standard Time and Other Details of the Record Card

Date 5/6 1912 1 Foreman
Order No. 31479 Piece No. 785 Job No. 1
Quantity 35 Dwg. No. 785 Op. No. 1
Chuck, face, & turn complete
Tools used Reg
Machines used Lathe
9½ - 27/9 A.G.T. Gen. Foreman
Workman Brown #133
Started 5/13 @ 3 P.M.
Form 16 Fisher Room Foreman

DATE	TIME	DATE	TIME
5/13	2		
14	7		

Name Brown
Clock No. 133 Job 1
Order 31479 Piece 785
Operation 1 Quantity 35

Fig. 4—The Two Sides of the Starting Card, the Initial Record of Actual Work

When the details of manufacturing a part have been planned out in the superintendent's office, no chance is given for any change of standard wage or time before the task is assigned to the workman. No official can make any alteration which he may believe would give better results to the company, or to himself in affecting his share in the profits. Occasionally in plants where a bonus system has been installed, one finds such changes are made, the planning department's figures being changed. Upon the blue working ticket Fig. 3 which goes to the foreman in whose department the operation is to be performed, is transcribed the complete record of the task as it applies to the workman, including the standard time and the nature of the work. This ticket is given to him that he may know the whole story of what is expected of him. He has been educated to insist upon seeing it. In a few cases of hurried jobs where men have been put to work before the work ticket had been made out in the office, his initial labor has been less efficient than in the period after he had received the card. It may be stated in this connection that the policy of the company is to keep the records pertaining to standard time and bonus wide open to the inspection of both foreman and workman. No misunderstanding can exist if the aggrieved person will make known his troubles at the superintendent's office. In any form of premium or bonus an essential factor is to preserve the confidence of the men. In the beginning the difficulty is to make them realize that no price cutting will be attempted. Once the system is working satisfactorily, the broad policy of open records will eliminate the suspicion and correct misleading rumors of price cutting which are apt to spread through a plant.

The Blue working ticket is the order to go ahead. The buff colored starting card, the two faces of which are shown in Fig. 4, is next issued. On the front face are the details of the operation, and its tools and machine, the standard time, the name and

Order No. 31479 Pc. No. 785 Drawing No. 785

Job No. 1 Quantity 35 pcs. Operation 1

Finished 5/17 3. P. M. 1912 by Brown Cl. No. 133

and have been inspected and accepted by

O. K. - INSPECTOR.

Form 17

4½ 9

Pay to Brown Clock No. 133

Bonus hours ½ rate 22 9/9 amount 11

On 5/18 1912

Signed W A T

Paid M.S. Charged M.

Fig. 5—The Finishing Card Which Goes with the Work Through the Inspectors to the Office To Be Filled Out for Bonus and to the Paymaster

number of the workman and the hour when the work was started. On the reverse side are columns for the workman's time by days. With the completion of the job the card goes to the office. The two sides of the pink finishing ticket are seen in Fig. 5. This goes with the completed work to the inspector. On the one side of the card is the hour when the work was completed, together with the general designations. After the inspector has passed upon the work the card goes to the office as a voucher that Brown has done his work and earned a premium. It checks the starting ticket. Upon it is inserted the number of bonus hours, the rate and the amount of bonus, and from these cards the paymaster compiles the bonus which the man has earned in a week. The receipt of this ticket is also the signal for the issuing of the blue work ticket for the next operation, unless it chances to apply to the finishing operation of the part.

Good Demand for Chain Hoists

The Wright Mfg. Company, Lisbon, Ohio, reports December the best month which it has ever had, both in outgoing shipments and in new orders. Among the shipments for the month were deliveries on several large foreign orders and the entire hoisting equipment for the new plant of the Wheeling Sheet & Tin Plate Company, Yorkville, Ohio. In connection with this report, the company remarks:

"During periods of business depression it is generally conceded that the machine-tool manufacturers feel the lack of buying more than any other class of manufacturers. Of the machine-tool manufacturers, we have found that the chain hoist and trolley makers are the first to feel the depression and the last to get over the effects of it. This is due largely to the fact that chain hoists are light enough to be readily moved from one part of a plant to another and this is done rather than invest in new equipment. With this in view, we are loathe to believe that business conditions are as bad as is generally supposed."

Progress in Alloy Steels at South Chicago

The Illinois Steel Company has made important progress in the past year in the development of electric steel, particularly of the nickel and chrome-nickel alloys. It is now equipped to furnish electric special steels for any purpose aside from tool steels, and the tonnage it has rolled for use in automobile construction, for spring steel and for agricultural implements has assumed notable size. The elimination of piping and segregation in the electric steel ingot has been an especially important feature of this progress. The tendency to piping in a highly deoxidized steel is particularly pronounced and constituted one of the greatest elements of cost for electric steel, the waste of a large proportion of the ingot being involved. By the adoption of an inverted ingot and pouring with a refractory top this piping has been remedied to such an extent that the sale of electric steels on a competitive price basis with open-hearth steel seems not far distant. The control of the steel in the furnace has also been perfected to a point in advance of any previous attainment.

The experiments that have been conducted in the past three years with reference to manganese steel have also brought practical results during the past year. With reference to manganese steel rails, the most important improvement in equipment has been the installation of a quenching tank which in size and cost goes beyond any previous appreciation of the requirements. The bringing out of the peculiar characteristic of toughness in the manganese steel is dependent upon quenching from the temperature at which the rail is rolled, as contrasted with the air cooling of carbon steel rails on the hot beds. It is also understood now that variations in the temperature of the quenching bath have an important effect and that the bath must be large enough to dissipate the heat from the rails without a rise in its own temperature. The quenching tank now installed affords a volume and an activity of circulation sufficient for this purpose. The quenching of the rails follows immediately after cambering, the rails being fed into the tank continuously. The tank is equipped with a chain conveyor upon which the rails fall in the tank and which is just speeded sufficiently to deliver the rails at the surface of the bath when they are completely cooled.

The obstacles which manganese steel presents with reference to machining have not yet been overcome and drilling the holes for bonding is still impossible. Punches have been designed and installed, however, which give a satisfactory hole, though expensive because of breakages under the severe duty required of the tools. The lack of machining qualities has operated against the rolling of manganese steel in other forms than rails, but where a heat of steel runs in carbon content above the limit desirable for rails a market has been found for it in the form of blooms which are subsequently rolled into bars. Some manganese steel plates have also been rolled by the company.

The rolling of manganese steel and of alloy steel has presented special problems, the solution of which has been considerably advanced during the year. It has been found possible and practicable to eliminate seams in alloy steel bars by chipping the seams in the billet. But experience indicates that certain alloy steels are especially susceptible to seaming or stratifying when broken down from ingot form by the process of rolling and even very slight reduction by passing them through rolls gives scarcely as good results as breaking down by hammering.

The Cost Problems of Jobbing Foundries

A Discussion of Factors That Enter Into the Determination of Profits—Examples from History That Is Repeating Itself

BY H. M. RAMP

The questions, "Why don't we make a profit in our foundry" and "Why can't we make castings cheaper," have agitated more or less the heart of every foundryman. Where these or similar questions arouse action relief is sought usually by the introduction of improved appliances, or by a change in the personnel of the supervising force. Such changes may bring the desired result, but often they fall far short of it. It sometimes occurs that plants with good buildings, well equipped and arranged and well managed, show no profit and perhaps a loss, while others not nearly so well situated either from the standpoint of facilities or administration do a creditable business and show a handsome profit. One manufacturer will take a certain line of castings into his shop and will tell you he made a fair profit on them. Another will take the same work and report a loss. Others will fight for years trying to meet some other man's price and never accomplish it. Still another will tell you he is getting three cents a pound and losing money. Some will tell you they have introduced machines, changed foremen and done everything they could around their foundry without attaining the desired result.

PRICE PER POUND MAY NOT INDICATE PROFIT

There are many reasons aside from shop practice why some foundries fail to make the expected return. These reasons include the character of the work, the method of purchasing supplies, the adaptability of shops and equipment to the particular work they are doing, the condition of their labor market, their overhead expense, their output relative to the investment, and last but not least, the price received for their product and the character of the competition they have to meet.

The first thing a foundryman should have in mind when considering the cost of his product is the character of the work with which he fills his shop. Three, four, five or ten cents a pound don't mean anything necessarily. Because some certain line commands an attractive price per ton, or some customer's castings run heavy is no surety that a contract is desirable. If the work is heavy and plain the cost may be light; if the castings are light and plain the cost of labor may not be heavy, but a larger floor space may be required. If the castings are complicated and intricate, another condition stares the foundryman in the face. If they contain many and expensive cores, the picture is changed again; and so the varying shapes, sizes and demands of the work make the cost an ever-varying quantity on practically every class of castings made.

A lathe builder not long ago raised the question why he was charged more per pound for the castings for his machine than was charged a competitor in the same district who made an almost exact duplicate of his lathe. The reason was plain to the foundryman, for the tool builder who complained had reduced the metal in his machine until the total castings weighed 10 per cent. less than those of his competitor. The foundryman who did the work had to use the same labor and floor space, also to bear the same overhead expense on the castings; yet when he came to sell them to his complaining customer he had 10 per cent. less weight to be paid for. It is only just that the tool builder who protested should pay more than the other lathe builder. Too often, however, foundrymen are governed by tradition or custom and base their prices upon some antiquated standard for certain classes of work and not upon the true cost of its production. Then they wonder why they don't make money.

IMPORTANCE OF REGULARITY AND SIZE OF ORDERS

Do the orders come along in a regular or spasmodic manner? There is no more expensive proceeding for a foundry than continually changing the size of its organization; taking on new men who are not acquainted with the shop or work, and who just about get acquainted with their surroundings when they are laid off because there is a halt in the orders. This practice means a higher cost for labor, more mistakes, more bad castings, in addition to only partial engagement of floor space and investment. Where castings are ordered in this manner they cost considerably more to produce than when orders come regularly, and they consequently should command a higher price. But how often does the foundryman receive a greater remuneration for these reasons?

The quantity in which castings are ordered also has a very marked influence upon the cost. Even if the total for the year is good, if the orders are for small quantities causing the constant changing of jobs and equipment, the foundry loses the advantage that is gained through a regular performance, and a condition results that is just one step better than the run of work with high peaks and low points. It matters little how well equipped a shop may be when the orders demand that a molder's job must be changed every day or oftener. Under such circumstances the maximum output cannot be obtained from labor or equipment. Every foundryman knows a molder will produce the same casting more easily the second day and even more easily on succeeding days than he will on the first. How often are these things considered in the cost of castings?

GREAT VARIETY OF PATTERNS A DETRIMENT

How many different patterns are used? The foundry that has a multitude of patterns to work from, even though the orders come regularly, has a serious handicap. The shops that run on specialties like radiators, brake shoes, agricultural work and similar products, illustrate the cost advantage it is possible to attain. Only a few patterns are used and the orders run for months on one pattern, enabling the supervising force to concentrate its attention on facilities and methods. More attention can be given to patterns, to machines and to devices that will reduce cost. The man with new patterns in his shop every day never has the time, and perhaps not the experience, to plan the cheapest way to do his work. His efforts to insure good work are spread so thin that he never achieves the greatest economy. It follows that the constant changing of patterns hampers the procurement of facilities for producing castings cheaply.

The standard set by the customer on the castings he requires is an important consideration. Are the requirements rigid or easy; must the castings be perfect; are the rejections heavy because of defects that develop in the operation of machining? Must castings be made to fit jigs, come perfectly clean or be of limited weight? If such is the case there is an additional item of cost on every pound made that may not be inflicted on the foundry across the way. Another question is, can stock be run if orders are irregular, or is it a case of being governed by a designer who periodically makes changes in design? All of these things and others have a bearing upon the cost of castings and they must be considered when comparisons are being made of the cost of the same product under different conditions.

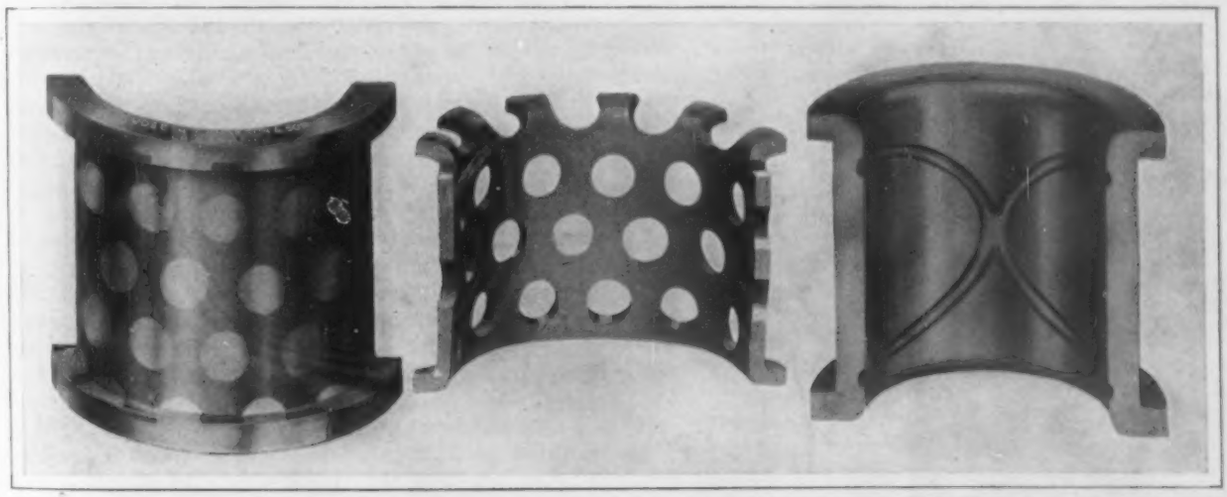
SOME FOUNDERS IGNORE OVERHEAD EXPENSE

Overhead expense is the great bugbear of the business man in the foundry; with almost every man figuring it on a different basis. It is the cost that enters into foundry production that is fixed as to amount. The more castings that are made the less it is per ton, and therefore when work is slack and the foundry least able to stand expensive production, when orders are small and output reduced, it mounts up with a rapidity that quickly eliminates profit. Some foundrymen charge it off so much per month, some so much per ton, and some operate their accounts so that overhead does not appear. Burden or overhead expense generally is considered as composed of interest on investment, depreciation, management, office expense, insurance and taxes, but many fail to include interest on investment, and some do not charge off for depreciation, simply charging maintenance and renewals to expense. Every concern is a law unto itself in this respect. It is difficult to arrive at a comparative cost when such variable methods exist.

A certain expensively built foundry whose method was to charge everything it could to the operation of the plant was trying to secure a contract for a certain line of work, but though possessed of several advantages, could never figure low enough to get it and could not understand how its competitor made the price he did. The competitor was an old foundryman who had saved ten thousand dollars from a life of toil and bought a small foundry plant at an auction sale. It was a foundry with fairly good buildings, two cranes, a good cupola blower and power plant, capable of producing about eight tons of castings daily. He was the owner, manager and foreman, and the only clerical help he had was one man who acted as timekeeper and shipping clerk and made out the bills. This employer knew nothing about interest or depreciation and all he figured on cost was what he paid for labor and material. All he received in excess of these he counted as profit. Naturally he had a very low cost for his castings. How could a plant managed by modern business methods compete with this foundry? Another plant in the same vicinity with a capacity of 100 tons a week came under the observation of the writer. It was capitalized for $200,000, had interest and depreciation charges that amounted to $35,000 annually and a fixed charge of $6.73 per ton on its maximum output. If business were reduced one-half, the burden charge would be $13.46 per ton. This may be good business method, but you can't meet competitive prices when the other man uses no burden in his. There are too many who figure like the old fellow who owned a foundry and who, when asked when he was going to take an inventory, said: "Take inventory? What for? I know how much money I've got in the bank. I know how much I owe. I know how much is owed me."

New Type of Reinforced Journal Bearing

For gas engines and other machinery where a removable and readily replaceable bearing is desired, Joseph T. Ryerson & Son, Chicago, Ill., have brought out a special type of bearing. It consists of a skeleton of steel or bronze embedded in babbitt metal. This arrangement is relied upon to give added strength to the bearing, as the reinforcement grips the babbitt metal both in the flange and the body of the bearing. The skeleton is interlocked with the babbitt metal to hold the two parts together at every point, and in addition to this, since the skeletons are pickled by a special treatment and tinned, a soldering takes place between the babbitt metal and the skeleton. The reinforcement is stamped out of a flat sheet and is then formed into the arc of a circle, with the result that the preparations are elongated on the back and the effect of a countersunk perforation which provides an additional locking of the babbitt to the skeleton is secured.



Views of a Recently Developed Reinforced Bearing for Internal Combustion Engines and Machinery Showing the Outside and Inside of the Bearing and the Skeleton Reinforcement

These bearings are made in two styles, one being machine finished all over to decimal sizes, while in the other the bearing is machine die cast to size and is not machined or tooled. In the first

S. DIESCHER
Mechanical and Civil Engineers,
PITTSBURGH, PA.

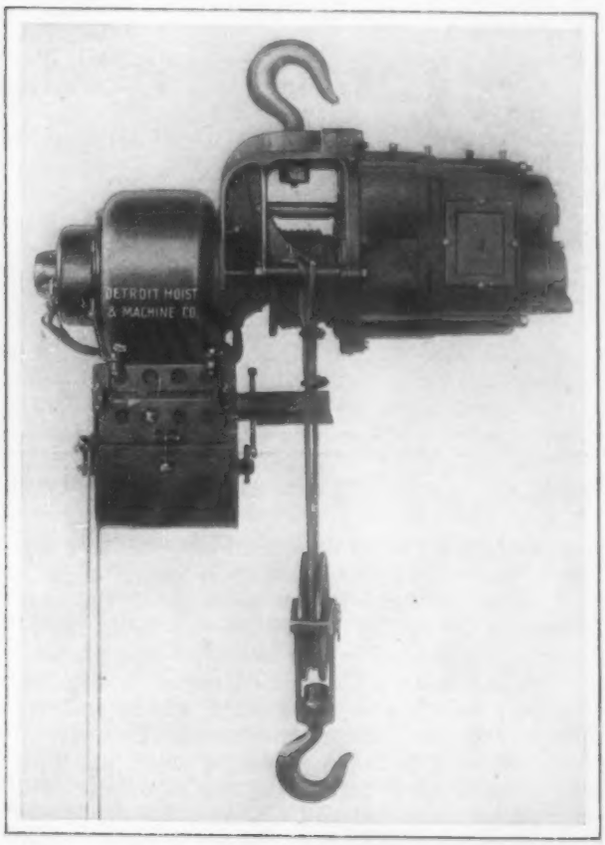
case, a highly finished and polished surface is offered to the pin or journal, while in the other the finish is that of an ordinary die casting.

Some idea of the additional strength provided by the use of this skeleton construction is found in the result of tests made on these bearings. While an all-babbitt casting of the same size could be broken with a few blows of the hammer, it was found that the reinforced bearing was simply flattened out or distorted under repeated blows.

New Portable Geared Electric Hoists

A new line of geared electric hoists of the portable type has been placed on the market by the Detroit Hoist & Machine Company, Detroit, Mich. With the exception of the motive power, the general features of the construction of this hoist are very similar to the line of pneumatic hoists made by the same company. The hoist is simple and compact in design and its maker has aimed to make it as near foolproof as possible. An important feature of the design is that the hoist is spur geared throughout.

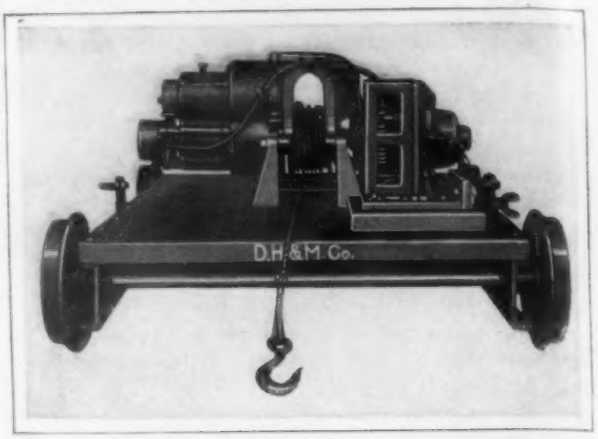
The two-piece frame is of malleable steel, the sides being of angle section and heavy ribbed, giving a rigid, compact arrangement of maximum weight and strength. The gear and brake cases are cast iron, carefully machined and fitted oil tight to the main frame. The gears are cut from tough, hammered, heat treated high carbon steel. These run in oil, insuring thorough lubrication. The bushings are of hard phosphor bronze and are interchangeable. Accurately fitted steel shafting



One of a Recently Designed Line of Electric Hoists Equipped with Spur Gears Throughout

is used. The motor has an extended shaft connected with the hoisting gears by a simple detachable coupling, by which the motor can be disconnected readily without disturbing the hoist proper.

The mechanical brake in connection with the gearing is mounted in a separate case, runs in oil and consumes no extra power when hoisting. It is stated that this brake will positively hold the load in any position and adjusts automatically to the load in lowering. The brake has no intricate parts, is simple, compact and adjustable to wear.



A Standard Hoist Mounted on a Car

The hoist is also equipped with a magnetic brake mounted on the end of the motor shaft and running in oil. This is magnetically operated by a coil connected in series with the motor and is adjustable to suit conditions of the load. A single automatic stop opens the circuit when the load block reaches the highest point. The motor bearings are provided with oil pockets and oil rings. As the gears and brake run in a bath of oil, the thorough lubrication of all bearings connected therewith is assured.

The hoist is equipped with an inclosed series-wound standard crane type reversible direct-current motor, the motor equipment being furnished for any standard voltage desired. The controller is of the rope-operated drum type, of compact construction with three points of control and designed for severe crane service. It is provided with a spring centering operating lever. All resistance is the compact wound unit type in a special non-destructive heat resisting composition and is arranged so as to be accessible to inspection or removal.

The hoist is built in seven sizes with capacities ranging from 1 to 15 tons. The 1-ton hoist has a 20-ft. lift, and the larger size a 12-ft. lift. The speed of the lift ranges from 28 to 8 ft. per min. The distance between hooks on the smaller size is 34 in. and on the 15-ton hoist, 65 in.

Various applications of the hoist can be made around industrial plants. A standard hoist can be mounted on feet for attaching it to a portable truck arranged for attachment to the track, the hoist being used for spotting cars and different hoisting operations. This hoist can also be attached to the mast of jib cranes or in any stationary position for hoisting. Its compact construction and general design make it a very flexible machine and admit its use in connection with a system of sheaves for various hoisting work.

An interesting example of continuous service is found in the East Pittsburgh plant of the Westinghouse Electric & Mfg. Company, where a machinist has worked constantly at the same machine, a 2-in. turret lathe, for over 22 years. Aside from its length, the record is of interest, as during this time the operator was only late on one morning.

Some Prime Principles of Salesmanship

Of First Importance Is Making Business Relations Agreeable Inside and Outside the Organization—Selling One's Services

BY STERLING H. BUNNELL

In this period of scientific analysis of thoughts and motives, the methods of work followed by successful men have become subjects of interest and investigation. First came scientific management based on the study of the methods of able men engaged in directing the work of factory employees. It was surprising to most men to find how absurdly simple were the principles of the system of scientific management as it was developed. Everybody seemed to have known and followed for years one or two of those principles; but it was nothing less than astonishing to observe that no one manager had discovered and adopted even half of the methods which were now so obviously sensible and wise. The scientific system of management, though principally the work of investigation and experiment in actual practice by a very small number of men, assembled the usual practices of many into a coherent plan. In this way was produced a code of procedure, with which every manager may compare the methods of the organization under his control and toward which as an ideal he may work.

A similar analysis was made of the methods of successful advertisers, and the basic reasons were discovered for the superior attraction of details like the top of the page, the plain Roman small (or "lower case") letters, and the wording of catch lines, up to the wonderful successes of "Phoebe Snow," "Spotless Town" and other hits. Now every one can buy more sound advertising sense in book form than the greatest advertiser of 20 years ago could possibly have gained in a lifetime of practice. Those who put little faith in the kind of practical science which is set down in books need only look through the files of old newspapers and magazines, and note the pages covered with empty repetitions of "best on earth," "beats all," "none such" and other unconvincing bombast. Following the now printed rules developed from the work of advertisers who have made good, almost any young man with ideas can now write advertising that will turn many buyers his way.

THE HIGH PLACE OF SALESMANSHIP

Salesmanship, too, has received a share of attention. Unlike managers and constructors, the salesmen work on the income side of the account. The big order gets more notice from the owner of the works than the well-made machines which fill it. The salesman is the link between the factory and the outside world. If he does not succeed in attracting the choice of the possible purchasers to the factory product, the business, no matter how well conducted internally, cannot succeed. Since the salesman's success is so vitally important to the business, his methods of work are of general interest, and have been analyzed and reduced to a science. While studying books will not make a man a successful salesman, much may be done by study to develop salesmanship in those not by nature gifted with it.

In its broadest sense, salesmanship should be studied, developed and acquired by every one, for the principles of action which make the salesman successful are the same which make the business life worth living and the day's work attractive. The man inside the organization can be personally agreeable or not, and yet he may perform the task for which he is employed. He may be an unpleasant associate, and yet the work may go on just the same. But the man in the front row must look to his method of meeting his fellow men whom he would influence and impress. He has goods to sell, which they need to buy; service to offer, which they want to use. If he makes his offer unattractive, another and an attractive tender will get the business. If he fails to set forth all the advantages of his line of goods he must accept a price reduced in proportion to his failure. His whole job is the putting of his case in the best possible light.

THE FACTOR OF AGREEABLE PERSONALITY

The conception of salesmanship as a science every one should understand and practice is one that is just beginning to be grasped. The art of presenting goods in the most attractive manner is just as useful for the man who has service to sell as for the man who is marketing machines or builder's materials. Some men, feeling sure that the goods they offer are something which the buyers must have, will not take the slightest trouble to make trading with them agreeable. They keep their trade accordingly just as long as their customers cannot find a substitute, and lose it just as soon as real salesmen with good substitutes come along; for no man will deal with disagreeable associates if he can find others.

The same rules apply to the relations of every individual with every other. Each man's job is secure only so long as no one appears who makes a convincing offer to do it better or cheaper. To get his chances, the newcomer must first make the convincing offer, and then be prepared to deliver the goods according to promise. To hold one's position needs the same qualifications in the reverse order; first the ability to do the required work, and then, care in doing the work so as to get full credit for its excellence. Good paper and cord induce many a purchaser to pay an extra price for the things wrapped up in them. Success generally comes to the man who does good work and dresses up that work attractively, while want of success is often due to nothing more than failure to turn out good work with an attractive outside finish.

MAKING AND KEEPING UP FRIENDSHIPS

Much of the good salesman's thought goes to making friendships and keeping them in good repair. Friends are the salesman's capital. He can keep his capital principally in his particular line of business; or he can even reinvest it without much loss, if he changes his position to another business house. The first thing he does when meeting a prospective customer is to establish friendly relations. The buyer always prefers to deal with a man he can trust, and whom can he trust other than a friend? The salesman, therefore, begins by studying the buyer's lines of thought and suiting his own to them. If one of the two men has many human interests, the other is almost sure to have one or

more in common. Whether sport, business, philanthropy or politics, a basis of friendship is found, and a structure as broad as possible is built up. While friendly relations are maintained, few if any serious disputes can arise. The buyer will listen to the arguments of the seller and give them every consideration, while the seller will observe the needs of the buyer, and try to satisfy them in character and quantity from the line he wants to sell.

The establishment of the friendly relation is the particular feature of good salesmanship which men not salesmen by calling are likely to neglect in their daily work. It is interesting to analyze the methods of men who are successful in difficult work, like the erection of machinery, where they stand between two different interests. The erecting man knows his materials, methods and men, and knows that they are as good as his employer could make them under the conditions. He knows also that the buyer of the apparatus has no very close familiarity with the work previously done, and will naturally watch critically to see that his interests are protected. The one thing the erecting man can do is to make friends with the buyer's representatives and employees, one and all, for the goods will be judged very much in the same light as the maker's representative is regarded. It pays the seller, therefore, to have his outside men devote time and effort to establishing cordial relations with those with whom they come in contact; but it is, after all, the outside men themselves who gain the most from their relations with the men they meet.

AGREEABLE RELATIONS WITHIN THE ORGANIZATION

Even within the factory walls, every man, from manager down, will help to increase his own measure of reward by looking carefully to his relations with the others. Good salesmen cannot afford to have enemies. Every such a one is a lost customer, whose business brings no commission or salary increase to the salesman. Unfriendly relations with other men are an expensive luxury which few can afford. One very successful manager says that he would invariably discharge the man whose associates desire that action; the loss of his abilities would not equal the gain to the pleasant relations of the force. The practice is worthy of careful consideration. It costs money for a man to change because he has let his existing job get unbearable. Dollars for advertising, hours in writing letters, answering inquiries and making calls, might better be saved by proper effort devoted to making the present job agreeable.

When a change must be made, the first care should be given to the principles of good salesmanship. The concern with a position vacant wants to fill it, and the official who has the matter in hand would rather find the first man satisfactory than wait to consider qualifications of a hundred following men. To sell one's own services well is not easy, because moderation in claiming ability happens to be conventional—though most inconveniently so in the case of a man applying for a job. But the friendly relation is always the first principle of salesmanship; and the man who can strike the right note, with due regard to the necessary relation of employer and employee, does much toward strengthening the advantage given him by his skill in the kind of work required.

ON THE EMPLOYER'S SIDE

In leaving a job, as in taking another, the retention of friendship is worth while, even if one has been badly treated. A man gains nothing by making his employer glad to see him go. The better course for his own self-respect would be to manage the departure so as to leave behind a sense of regret at losing a good worker.

Managers are generally more ready than are workmen to read and listen to new theories and methods connected with their daily work. How far they are profiting by adopting good ideas from the salesman's ways of work is evident in many ways. One is the "safety first" movement, which, while it tends to save part of the heavy cost of accidents, is of more value in promoting a feeling on the part of the worker that his soundness in life and limb is a matter of interest to his employer. Another is the quotation of dispassionate articles on railroad necessities, in the time table folders of the more important lines. The traveling public thus acquires knowledge of the railroad's difficulties and sympathy for those who are trying to solve them. When every man applies the same policy of interesting himself in what others think of him and his work, the business world will have gone a long way toward the time when good fellowship will not be found mostly in the front rank of the sales department.

MAKING MAILING CASES

The Special Machinery Employed for Metal Lined Tubes

For producing paper mailing cases with a tin bottom and a tin screw cover, Charles Leffler & Co., Brooklyn, N. Y., have developed a number of interesting machines. The demand for suitable cases for mailing articles since the adoption of the parcel post in this country has increased materially and that has resulted in the development of a line of somewhat special machines.

In the making of mailing cases the tin parts are stamped out by dies in power presses, one operation each being required for the bottom and the cover, while the ring which is fastened to the top of the case is produced in two. The ring and the cover have the thread rolled on them in a screw thread rolling machine, after which the ring and the bottom are ready to be fastened to the body.

The bodies are made from narrow strips of paper which have been slit from a wide roll and rewound. Two operations are required for making the body, the first of which is the winding of the tubes. This is done in a spiral tube winding machine such as is shown in the lower of the accompanying engravings. Several thicknesses of paper are wound around the tubes and this is a continuous operation, each ply being taken from a separate roll of paper. The machine illustrated is making what are known as two-ply tubes, and in this case one of the strips is glued while the other is not. The roll for the unglued strip is simply mounted in the paper stand and is shown in the foreground, while the roll for the glued strip is mounted at one end of a glue pot and the strip of paper guided across a glueing roll and scraper before being fed to the winder. In the gluepot, all the rolls and shafts are carried in an independent frame resting on top of the machine. The glue is held in a separate pan with flanges resting on the square cast-iron body of the machine and under the frame with the rollers. Water, which is kept hot in the cast-iron body by steam pipes or electric heating coils, keeps the glue in condition for use.

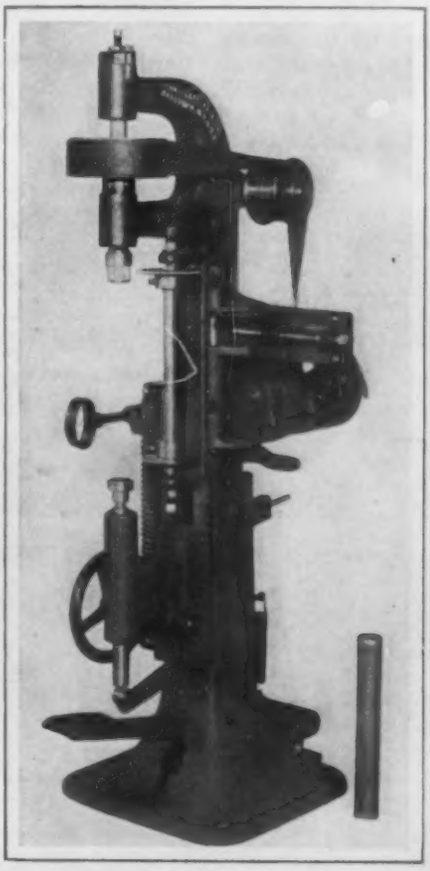
The tube winding machine consists of a round stationary arbor around which the paper is wound by two driven belts. The ends of the strips of

paper are wrapped around the arbor until they pass under the first belt. The belts continue to draw the paper in and wrap it into a tight continuous tube which comes off at the end of the arbor, this tube being cut into lengths by a rapidly rotating steel saw. The saw is mounted in a V-shaped arm controlled by compressed air so that when the end of the tube hits the target at the end of the machine the compressed air is applied to move the saw in and cut off the tube. An air compressor is supplied with the machine and the pressure tank is located in the bed. The machine has a chain drive and is driven by a friction clutch pulley which will throw out of engagement before any damage is done to the machine if some glue should get on the arbor. The capacity of this machine is tubes from 1 to 6 in. in diameter and from 12 in. up in length, a separate arbor being required for each different diameter of tube.

As the saw of the tube winding machine will not cut the ends clean enough to permit the tin bottoms or tops to be inserted, a tube cutting machine is employed which will also cut the sticks, as the product of the winding machine is known, into different lengths of bodies. This machine consists of a rotating steel mandrel, over which the stick is slipped, and a set of circular steel cutting knives. Pressure upon a foot treadle raises the supporting lever to the free end of the tube and then forces the knives in to split the tube. This machine will handle tubes ranging from 1 to 6 in. in diameter not exceeding 39½ in. in length.

After the bottoms and screw rings have been prepared the mailing case is completed by fastening them to the body. This is done in one operation on an automatic double-end upright crimping machine which, as its name indicates, crimps the bottom in place and knurls the screw ring on simultaneously. The tin pieces are put in place on the body which is then set between the chucks and the operator presses the treadle. This machine will handle cases from 1 to 6 in. in diameter by 15 in. long.

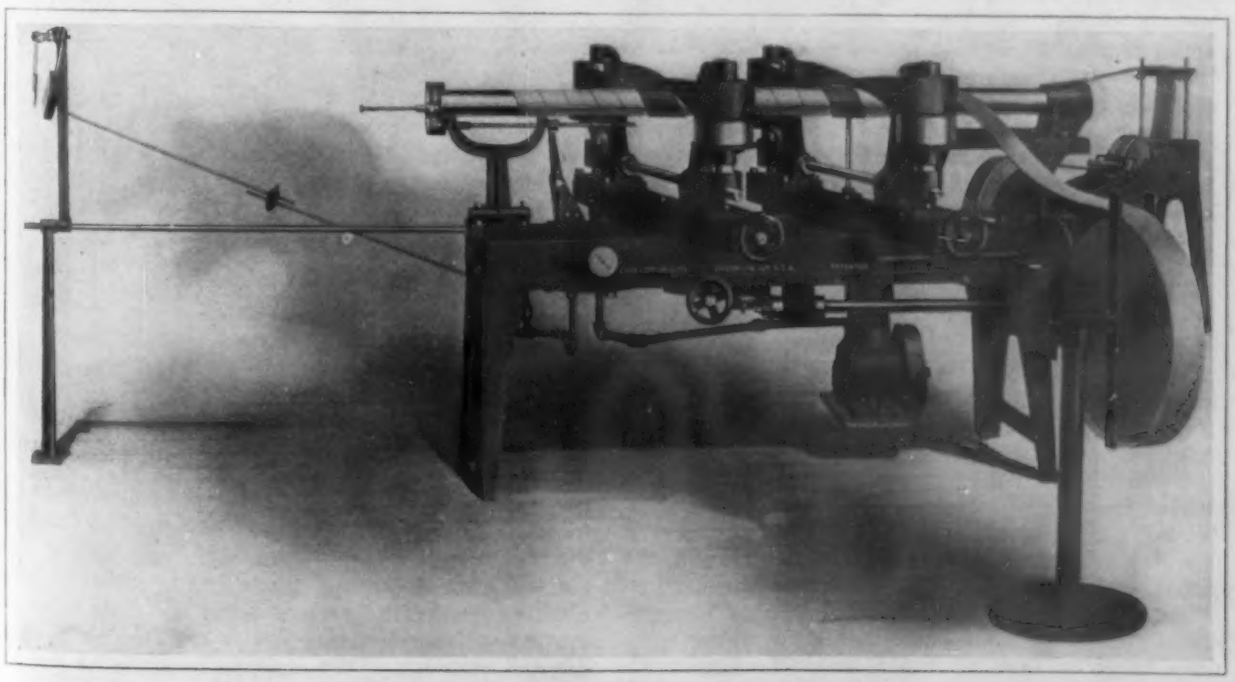
In addition to making mailing tubes, the winding machine is also used to produce tubing for many other purposes, such as cores, battery cases, cans, etc., in connection with other special machinery designed for doing the work.



Machine for Finishing the Ends of the Tubes

The fortnightly bulletin of the American Railway Association shows that on December 15 there was a net surplus of freight cars on the lines of the United States and Canada of 101,545, which represents an increase of 44,311 cars in the first half of December. In the two weeks the net surplus of box cars increased from 22,492 to 40,417, while the coal car surplus rose from 12,526 to 34,140. The reports issued during the past two months have shown a steady increase in idle cars. The minimum surplus of the year was on November 1, when the number was only 1842.

The Washington Iron Foundries, Seattle, Wash., made its first steel castings December 16, with the Girod electric furnace. This event marked the successful inauguration of a new industry in Seattle. Nearly twelve months has been spent in the construction of the new steel foundry building. The furnace, of General Electric make, is of 3 tons capacity and scrap steel is used.



The Machine for Winding and Cutting Off the Tubes

The Improved New Britain Automatic

A Double-Head Chucking Machine Containing Important Changes—Some of Its Products and the Methods of Their Manufacture

Since the New Britain Machine Company, New Britain, Conn., commenced the building of its automatic multiple-spindle chucking machines, its engineers have made many important changes in the design as compared with the model which was presented to them for development four years ago. The improvements have speeded up both the single and the double head types at least 20 per cent., and the degree of accuracy of the various operations, under commercial conditions, has been increased in a large way. Much metal has been added until the weight of the No. 53 type, the double-headed machine shown in the illustrations, is 1000 lb. greater than its predecessor, or 4500 lb. The speed and accuracy with which pieces of widely varying character and size are manufactured are described and illustrated by several examples of the operations later in this article. The scope of the work which can be performed has been increased by the designing of improved tools and fixtures for holding the work.

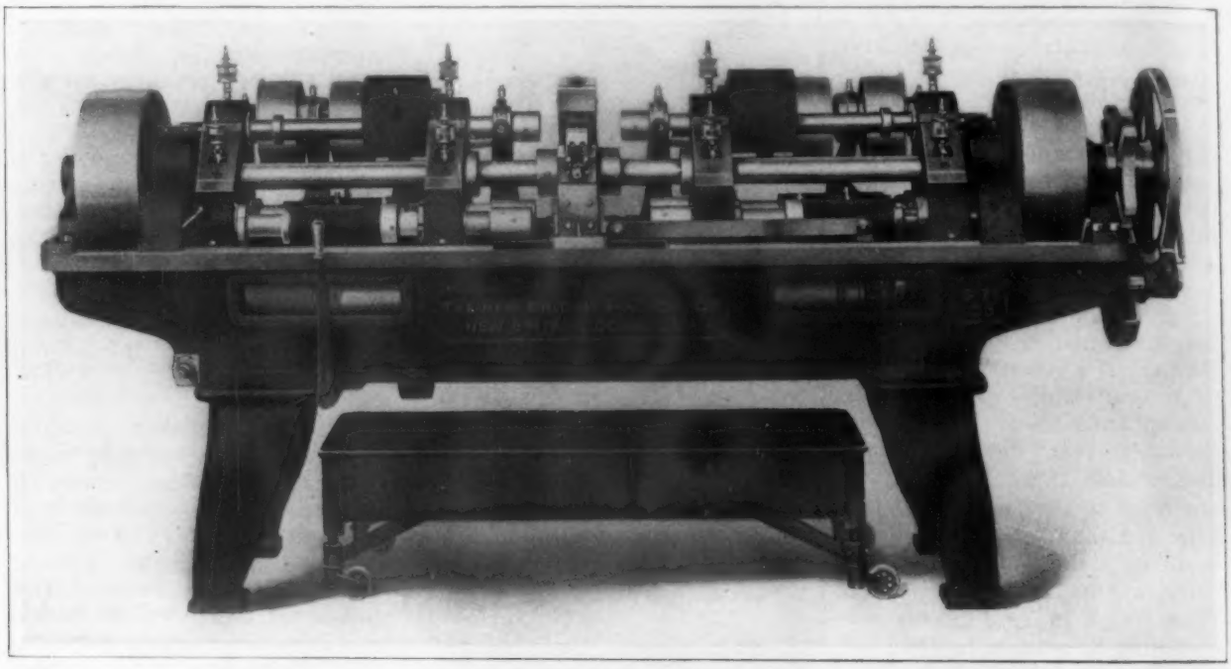


Fig. 1—The Improved New Britain Double-Head Automatic Multiple-Spindle Chucking Machine

Referring briefly to the characteristics of the machine, its speed of production results, generally speaking, from the fact that the operations on a given piece are proceeding simultaneously. The spindles carry and rotate the tools while the work is held stationary in the several positions of the multiple-chuck turret, which indexes to bring each piece in line with the next succeeding spindle. The turret has one idle position in order that the operator may remove completed work and insert a rough blank. Except for the loading operation, the machine is completely automatic, the various mechanical motions being actuated by cams. The machine chosen for illustration has six working spindles, three in each head, and four chucking positions. It will turn brass, iron and steel pieces up to 2¾ in. machined length on each end, of a diameter of 1¾ in. brass, 1½ in. in iron and 1¼ in. in steel, and will bore to a greater capacity than these respective diameters. In brass it will thread with solid tap or die, straight, 12 thread, 1½ in. in brass, 1¼ in. in iron and 1 in. in steel; and taper pipe ¾ in. in brass and iron and 1½ in. in steel. Larger diameters are turned and bored when the length of cut is less than the full stroke of the feed cam. The largest diameter of round work that can be held in false jaws is 3 in., the maximum swing of work outside of jaws 4½ in., the width of chuck jaws 1⅞ in. and hight 1¾ in., and the jaws open to receive false jaws 4¾ in.

Referring to Fig. 2, the indexing is performed by simple mechanism, the fundamental principle of which is the Geneva motion, that very gradually accelerates the movement of the heavy turret in the indexing and as gradually checks its momentum so that there can be no shock. An essential feature is the increasing of the size of the index dividing wheel to a diameter greater than the circle of chucking positions, which serves to refine still farther the accuracy of the index at the working positions. The automatic spring-operated latch, which defines the turret position when locked in the notches of the index wheel, receives no strain, serving only to align the slot in the turret in position for locking to the machine bed through the agency of the steady rest.

Equally important changes have been made in the steady rest. It is of the sliding key type and automatically locks the turret to the bed of the machine during the periods when the tools are operating. Naturally, this device adds much to the life and accuracy of the machine because the turret shaft, as well as the indexing mechanism, is re-

lieved of all the strain of the machining processes. When the rest is closed, the tongue of the turret fits closely into a groove in the steady rest. In the original type no groove was employed, the tongue pressing only against what is now the lower surface of the groove. The change gives a much more positive locking. Provision is made for taking up any wear. The lower surface of the groove is the upper face of a wedge which is operated by an adjustable screw at each end, movement to the right elevating the surface until it rests in the requisite position in relation to the tongue. To complete the adjustment, the bottom of the outer section of the rest, which forms the upper surface of the groove, is drawfiled to permit the lowering of the piece, thus procuring the nicety of fit of groove and tongue. The steady rest is gibbed at all points where there is wear.

The differential or hurry-up motion is an important attachment for use with work requiring a slow feeding speed, because in the interval of indexing it causes the turret to operate at several times the speed permissible while the tools are in operation. The feed belt is thrown automatically from the slow to the high speed pulley, and vice versa, by a cam-operated upright belt shifter. In case a machine fitted with a differential is to be used on brass work requiring a very coarse feed, the attachment can be thrown out of action by the removal of the shifting dog.

The threading spindle has been greatly changed. In the original type the spindle itself had no longitudinal movement, the action of the die or tap being accomplished by a sliding head which moved with the pitch of the thread and floated on two round studs integral with the spindle which imparted the rotating motion. The result was that the point where the greatest strain was sustained on the tap or die was mechanically the weakest, owing to the twisting action of the tool, which created a tendency for the tool head to bind on the studs. In order to overcome this the new machines are equipped with a spindle, the head of which constitutes the tool holder. Instead of the head advancing by itself the whole spindle advances, giving uniform resistance to torque in all positions in relation to the work.

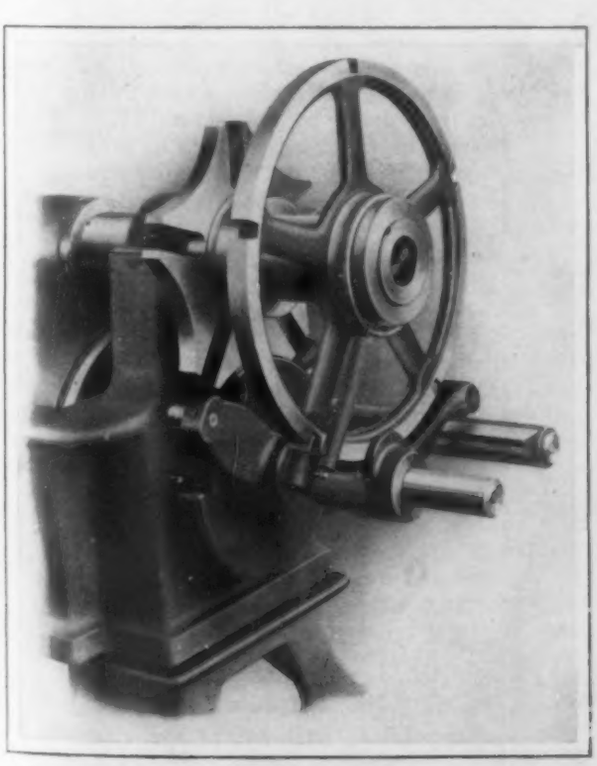


Fig. 2—The Indexing Mechanism Showing the Enlarged Dividing Wheel

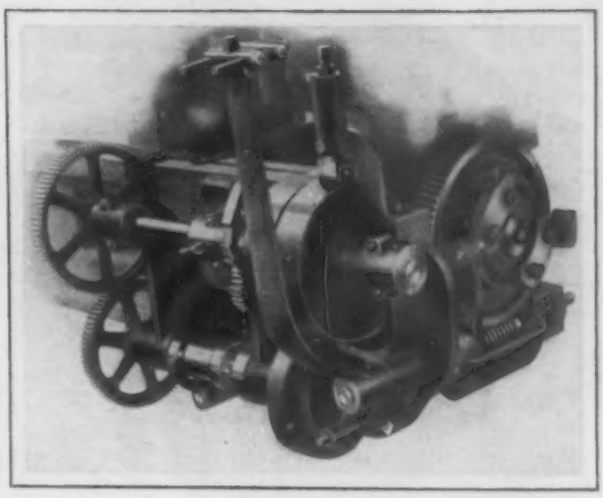


Fig. 3—The Differential and Change Feed Gears

The combination tap and die head is designed to cut simultaneously internal and external threads of different diameters and pitches on the same end of a piece of work. The tap is fastened directly to the sliding spindle and threads according to its pitch. The die slides on the tap head and leads on with its own pitch. Each has its own starting lever and cam so that it is entirely independent axially, but the two act in unison rotatively.

In Fig. 4 are shown three typical pieces of work performed on the double-head automatic. One is an iron piston of an internal combustion engine, another a brass sprinkler head, and the third a 2-in. malleable iron union nut. Each presented problems of accuracy and high production which in combination give a very good idea of the usefulness of the machine in manufacturing economically on a large scale.

The piston job had to meet very exact specifications as to limits of accuracy. The machine drills and reams the wriest pin hole in the unfinished casting. The bottom and the inside diameter of the bottom are finished before coming to the New Britain Machine Company. The 15/16-in. hole must not vary more than 0.0015 in. in diameter, or in its distance from the bottom of the piston, or in its central position through the casting. The two bosses through which the hole passes are each 1 5/16 in. long. Yet the production is at the rate of 90 pieces per hr. The pistons are located from the finished surfaces on plug fixtures which have spring equalizing arms that act to make the bosses line up with the drills. The latter are guided by hardened jig bushings which are located in fixed brackets solid with the bed. The first pair of spindles carry two-flute twist drills which drill the holes from the solid. The second spindles are equipped with three-flute chucking drills which straighten the holes and leave 1/64 in. for reaming. The third spindles line-ream from one side of the casting which operation brings the two holes into perfect alignment.

In manufacturing the malleable iron union nuts, the machine is equipped with special false jaws for holding the work, each chuck holding two nuts and each head of the machine carrying all the tools necessary for complete operation. One of the false jaws of each chuck is of the spring equalizing type which takes care of any variation in the size of castings so that both are gripped with equal pressure. The first spindle has a tool which bores the

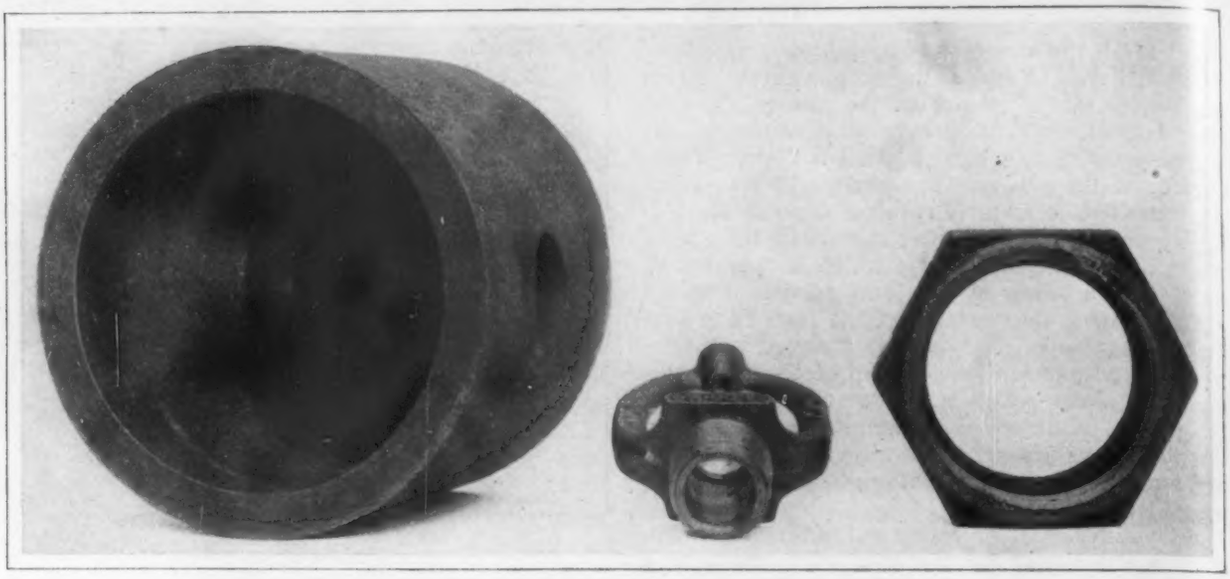


Fig. 4—Samples of Work Machined by the Double-Head Automatic

thread diameter, the second spindle bores the small diameter and faces the inside, while the third does the tapping. The machine produces 550 completed nuts per hr.

The sprinkler heads are held in special chuck jaws, as shown in Fig. 5, the left head performing the operations on the small end and the right head on the other. The left head is arranged to operate at high speed so that the small drilling, turning and tapping operations, including spotting and drilling through the solid, may be done in the same time required for the operations on the cored end. The first spindle at the right end rough bores the large diameter hole, while shank cutters face and chamfer the end. The second spindle finishes the boring of the large hole, the tool acting as a pilot for the tool of smaller diameter, which is in combination with it, that bores the smaller hole, which must be exact to size within small limits. The second spindle also taper turns the surface which is threaded by the third spindle. On the left end, the first spindles spot the casting for drilling, while shank cutter heads shape the end. The hole is drilled by the second spindle and tapped by the third. This piece is produced at a correspondingly rapid rate as the other two.

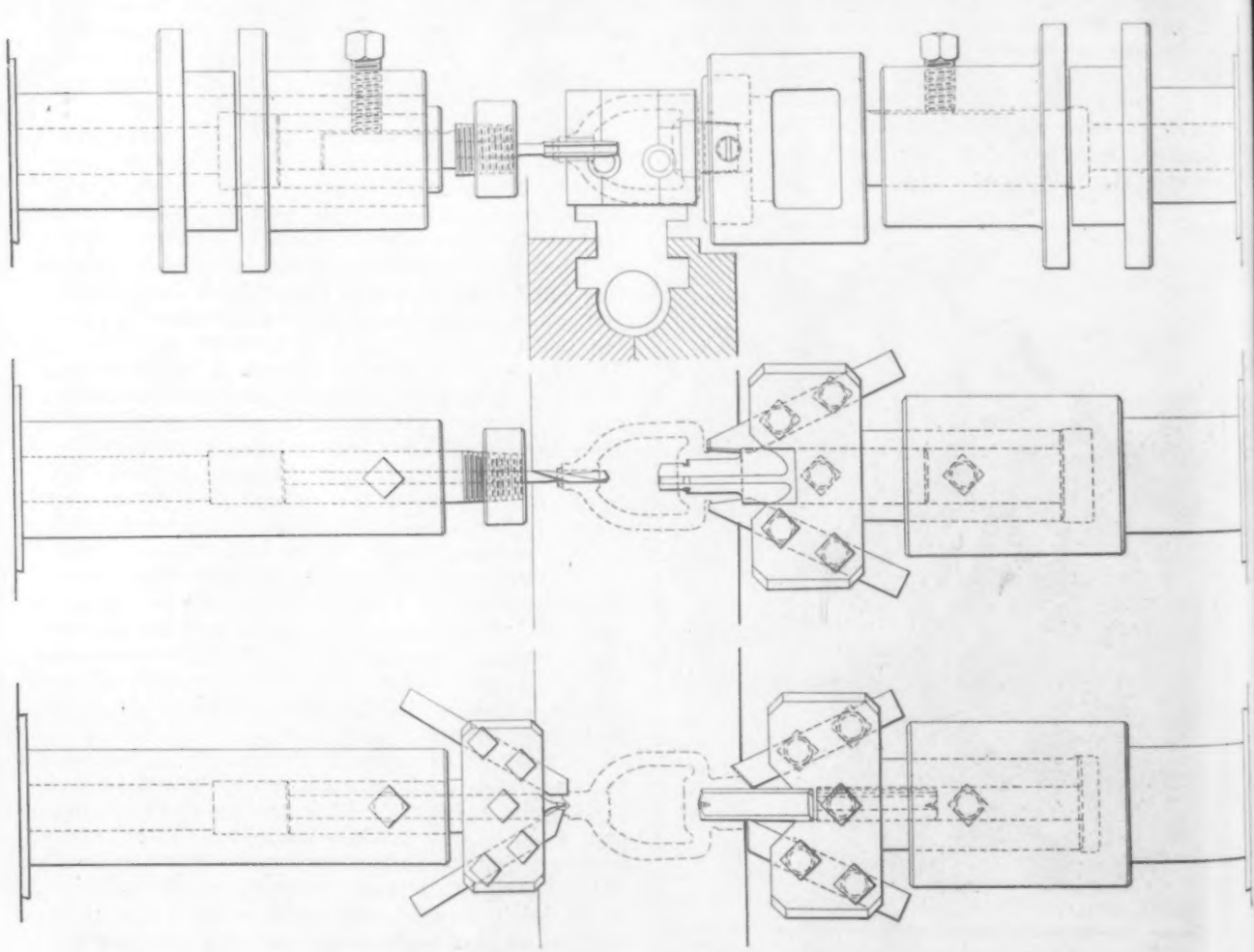
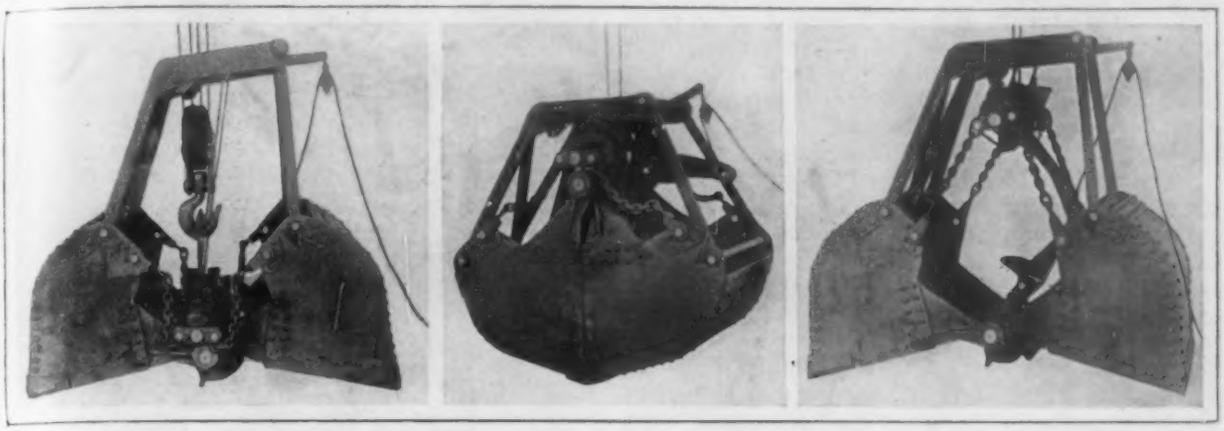


Fig. 5—The Layout for Producing Sprinkler Heads

A New Type of Clam-Shell Bucket

A single hook clam-shell bucket for use on any overhead crane or hoist for handling bulk material has been recently brought out by Edgar E. Brosius, Machesney Building, Pittsburgh, Pa. The bucket requires but little headroom, which it is emphasized enables it to be used to advantage for almost any crane installation. One of the most important features of the bucket is the fact that the hook block of the crane passes down through the bucket in latching and the maximum travel of the hook block is secured in closing the bucket. The travel of the block is approximately 8 ft. in the 2 cu. yd. size, which is 10½ ft. high. It is also possible to attach and detach the bucket from the crane hook as readily as a chain sling, and it is tripped by the hand line from either the operator's cage or the ground. In addition to cleaning up foundry floors, this bucket, it is pointed out, can also be used for excavating and handling coarse material of all kinds.



Three Views of a Recently Developed Clam-Shell Bucket Having a Special Closing Arrangement Showing the Different Positions Assumed

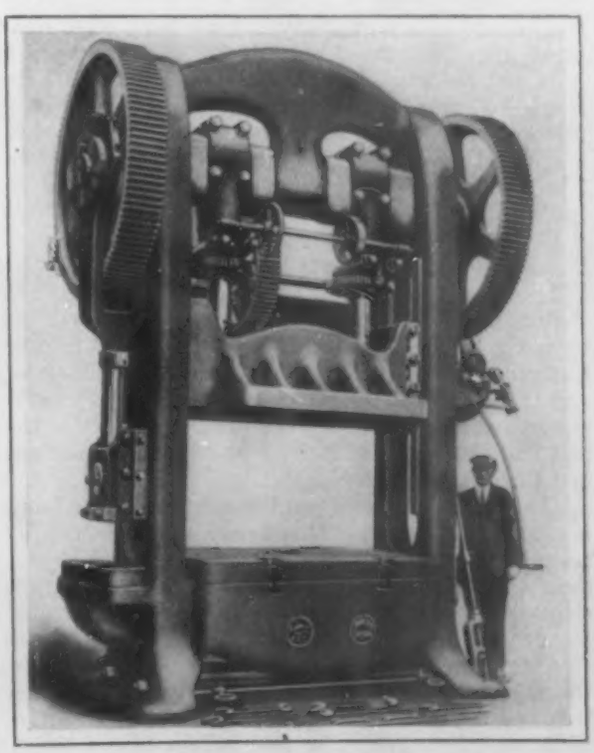
In operation, when the bucket is loaded and in the closed position, the trip line is pulled, which permits the bucket to drop open and at the same time, the crosshead stays against the upper arms of the bucket until the side chains that are attached to the scoop of the bucket pull this down. This pulling down action in relation to the upper arms causes the bucket to climb the line and is relied upon to absorb the shock of opening.

As will be noted from the cut, there are two side chains, one on each side of the bucket. These chains pass over rollers in the crosshead and are fastened to the side plates of the bucket. The points at which the end chains are attached to the bucket sections are located so that as the bucket drops open they move inward and downward about the axis of the outer shaft, which it is pointed out exerts a constantly increasing leverage on the bucket sections in a direction tending to restrain the opening movement. The pull of the chains is transmitted from the bucket sections to the crosshead and causes the latter to move down a short distance with relation to the upper arms of the bucket. This downward movement, by reason of a 2 to 1 reduction in the rope for lifting, causes the bucket to climb the hoisting rope, the bucket absorbing its own work in opening without requiring any outside attachment. The latch releasing lever works on the roller bearing principle and it is claimed that very little pull of the trip line is required to release it.

The bucket has been used in foundry work for cleaning up the molding floors, handling the shake-out sand to and from the sand mills and for filling molds. In one particular installation a saving of 12 laborers a day was effected as a result of using one of these buckets, and it was found possible to run one more heat a week, due to the fact that the cleaning up was done quickly and the molders were allowed to return to the floor that much sooner.

Double-Crank Single-Action Presses

A new line of double-crank single-action presses, all capable of exerting the same pressure, 300 tons, has been placed on the market by the Ferracute Machine Company, Bridgeton, N. J. These presses are built with various widths between the columns, the one illustrated being the fourth size of the series, which has a space between the columns of 76 in. This line of presses is equipped with side punches, which virtually makes two machines in one, as a side press can be used for a number of purposes, such as the shearing of stock before or after it has been worked in the main press, punching holes, etc.



One of a New Line of Double-Crank Single-Action Presses Capable of Exerting a Pressure of 300 Tons

The shaft is a high carbon steel forging having a diameter of 8½ in. at the journals and 10 in. at the cranks. The standard length of stroke is 3 in., but the presses are designed for any stroke up to a maximum of 24 in., which is the length of the stroke of the press illustrated. An adjustment of 4 in. by a worm shaft connected by gearing to the pitmans, the action on which is simultaneous, is provided for the ram. The worm shaft can be revolved by hand, but a pulley is also furnished so that the adjustment can be made by electric motor, if so desired.

The press, which is adapted for a large variety of cutting and forming in either hot or cold metal, contains a combined friction clutch and brake for starting or stopping the ram at any point of its stroke. The diameter of the flywheel is 40 in. and the face is 12 in. wide. Its weight is 1800 lb. and the speed is approximately 400 r.p.m. The twin gears are 76 2/3 in. in diameter with a face width of 11 in., the ratio of the gearing being 40 to 1. The bed is 50 in. deep and there is a rectangular hole 58 in. wide and 36 in. deep. The thickness of the bolster is 5½ in. The approximate weight of the press is 72,000 lb.

A New Motor-Driven Forging Hammer

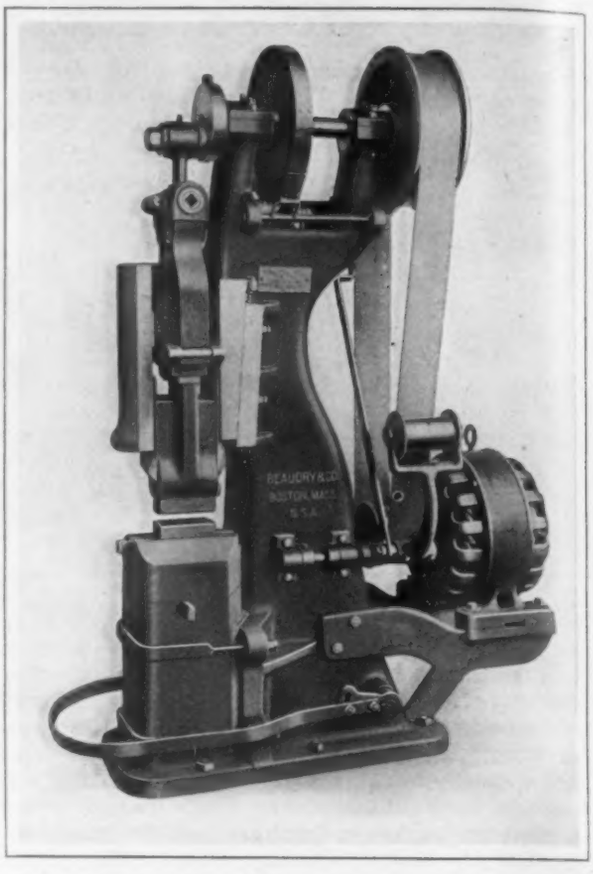
For use in places where there are objections to the use of overhead shafting or where the blacksmith shop is isolated from the main power plant, Beaudry & Co., Inc., 141 Milk street, Boston, Mass., have applied motor drive to their Peerless power hammer, which was illustrated in *The Iron Age*, October 3, 1912. This tool can be used for drawing and plating steel in the manufacture of edge tools, for agricultural implements, shovels, spindle and general tool making and in forging operations of all kinds where a very quick blow is needed. The machine can be operated at a high rate of speed and is intended for continuous service.

All the working parts of this hammer are of steel, there being no beam, coil springs, leather straps or rubber cushions. Two long steel links serve to connect the ram with the spring arms, and it is pointed out that this arrangement while designed to occupy a small amount of space, also gives freedom and lift of the ram and imparts a cushioned and powerful blow through the spring arms. The tension on the spring arms and links is adjusted and maintained by nuts in the spring box.

A foot treadle extending around the base of the machine stops, starts and regulates the motion of the hammer, and by varying the pressure any desired speed or force of blow can be obtained, the treadle working in connection with the belt tightening pulley and a friction band brake. The diameter and face width of the pulley are both large, thus, it is emphasized, giving a large area of contact to the belt and causing the hammer to respond to a slight pressure on the treadle.

As will be noticed from the engraving, the anvil is a separate casting with a flange at the bottom for bolts and a wood filler is employed between it and the frame to eliminate vibration. Strap bolts are also used to secure the anvil in place. To enable any length of bar to be worked either way of the dies, the anvil is slightly offset to clear the main frame casting. An independent adjustable shoe die is furnished with the anvil.

A one-piece casting is used for the frame, which is rigid and occupies a small amount of floor space. The ram, which is machined and fitted into heavy



A Recently Developed Forging Hammer Equipped with Electric Motor Drive

V-shaped guides, is adjustable on its connecting rod for different hights above the dies and is practically contained within the die at all times, an arrangement which is relied upon to give perfect alignment of the dies and a square and true blow. These guides are cast solid with the frame and an adjustable composition tapered gib is fitted to one of them to compensate for wear.

The steel crankshaft is of large diameter and runs in a long bearing, which is provided with a babbited bushing that is chambered for the lubricating oil. The crank pin can be adjusted for varying lengths of stroke and the connecting rod, which is also made of steel, runs in a hard bronze sleeve, recessed for the lubricant. Keying to the spring box provides an easy adjustment for the various hights of the dies. The spring box is made of steel, and the two spring arms to which the links are hooked are fitted into it. These arms are kept in place by two tension nuts which maintain the tension on the arm and serve to adjust it. Swedish steel forgings are used for the spring arms and the links are of steel castings.

The following table gives the principal dimensions and specifications of the largest and smallest of seven sizes of the hammer:

No. of hammer	1	7
Weight of ram, lb.	25	200
Lift of ram, in.	5	8
Speed of hammer, stroke per min.	375	250
Diameter of driving pulley, in.	15	18
Hight, to center of shaft, in.	63	81
Size of dies, in.	6 x 3	8 x 4
Size of motor, hp.	2	5
Speed of motor, r. p. m.	900	850
Aproximate weight of hammer and motor, lb.	1,900	5,000

Either direct or alternating current motors can be used for this tool. Independent anvils are furnished for all sizes of hammer, and these clear the main frame casting in both directions, so that bars of any length can be worked either way of the dies.

New and Projected Work on Witherbee-Sherman Properties

In the latter part of 1912 No. 4 iron ore concentrating mill at Mineville, N. Y., was started up but not until early in 1913 was it actually completed. The plant has a capacity of approximately 1000 tons of crude ore in 10 hr., arranged so that the product of the Barton Hill mine, on day and night shift, can be handled in the day time. The mill produces an ore of about the following analysis: Iron, 65 per cent.; silica, 6 per cent.; alumina, 0.4 per cent.; lime, 0.4 per cent.; phosphorus, 0.025 per cent.; sulphur, trace.

A plant for the electric cobbing of Old Bed 21 crude furnace ore, eliminating hand cobbing, was completed in 1913. The electric cobbing plant is found to give a more uniform product, as the ore is crushed before being cobbed, and it also raises the metallic iron contents slightly.

Preliminary plans are being prepared for a modern storage dock at Port Henry, N. Y., having about 500,000 tons capacity with a bin system for rapid loading of boats, similar to the ore docks in the Lake Superior district. The enlargement of the Champlain canal allowing for boats carrying 1500 to 2000 tons of ore make a change in the docking facilities at Port Henry necessary. It is expected that the enlarged Champlain canal will be completed throughout its entire length in the spring of 1916. Houses of a new and thoroughly up-to-date type are being built of concrete in which the tailings from the concentration of iron ore are used.

A plant of a capacity of about 35 tons per day for the production of a commercial fertilizer from the tailings of Old Bed ore is being built. It is expected that the plant will be ready to start up about the middle of January.

Further exploration and diamond drill work on the company's Ausable properties have shown up additional iron ore. In this district about 22,000 acres of mineral land is now controlled in addition to that at Mineville and vicinity. The Ausable ore is for the most part very low in phosphorus, but will require concentration to make it marketable. The exploration work at Mineville aside from the regular development of operating bodies has been at the so-called Sherman-Hall mine, about 1½ miles from Mineville, where a large body of low phosphorus ore has been located, and a shaft is now being sunk, but it is not intended to mine ore actively in this location at the present time, but simply to prepare the mine so that ore can easily be taken out when the market warrants its further development.

Careful study has been made of the advantages of New York Harbor as a location for the manufacture of pig iron, on the completion of the barge canal system, and with that end in view an option has been taken by the company on a site on Arthur Kill, near Perth Amboy, N. J., as mentioned in these columns.

The output for the first ten months of 1913 was exceedingly heavy, and had it not been for the depression in November and December, the shipments from the Port Henry district would, it is believed, have beaten all records.

Effective January 1, Fuller Brothers & Co., 139 Greenwich street, New York City, have been appointed Eastern sales representatives of the Parkersburg Iron & Steel Company, Parkersburg, W. Va., maker of black and galvanized sheets and Parkersburg blue annealed sheets.

Taylor-Wharton Additions

The Taylor-Wharton Iron & Steel Company made a number of improvements and additions to its plant at High Bridge, N. J., last year, chief of which was an extension on the main foundry providing for an increase in capacity of the rough grinding (fettling) department 50 per cent. Motor-driven grinding machinery of special design with ball bearings was installed. There were also built a new shipping office, new office for works inspectors and quarters for foreign inspectors. A new wash room, provided with shower baths, toilets, etc., will be built adjacent to the new extension for workmen employed in this end of the plant. In the fettling department an additional electric welding outfit of 400 ampere capacity has been installed. In addition a number of Blau-gas portable outfits have been purchased for use in various departments. Many new molding machines have been installed in the main foundry.

The grinding department for manganese steel conveyor chains has been increased in capacity by new equipment consisting of specially designed double grinders, all equipped with ball bearings, and suitable safety hoods connected with exhaust systems. Several miles of additional track has been laid in the yard, providing a belt line around the entire plant, and the facilities for unloading and storing pig iron, wrought scrap, etc., improved by additional tracks, bins, etc. An additional locomotive crane with lifting magnet has been put in service.

Power plant additions are a 200-kw. alternating current motor and a new motor driven air compressor. The compressor doubles the capacity of the air plant.

A "first-aid" room has been provided with full equipment and a trained nurse is in charge at all times. The company has built additional four-sectional houses, and a number of single houses are nearing completion.

The Tioga Steel & Iron Company, a subsidiary company, has purchased a tract of land at Easton, Pa. It is the intention to build at some future time and move this branch of the company's business from Philadelphia.

At the Twenty-fifth street and Washington avenue plant of the William Wharton, Jr., & Co., Inc., one of the subsidiary companies, in Philadelphia, a large number of special grinding machines have been installed as well as a number of high speed drills and other machines especially adapted to track work. At the Jenkintown plant of the same company new rail bending machines, drills and special grinders as well as several lathes have been added, greatly increasing the capacity of the plant. This has necessitated the building of several corrugated iron buildings to relieve congestion in the shops.

A Tire Mill at Midland, Pa.

As soon as the various buildings the Pittsburgh Crucible Steel Company has under construction at its steel plant at Midland, Pa., are completed, it will begin the erection of the largest mill in the country for making tires. It will be largely automatic and motor drive will be used throughout.

The Chicago Steel & Bridge Works has been awarded the contract for building a standpipe and reservoir for the Canal Dover water works, Canal Dover, Ohio. The Massillon Iron & Steel Company, Massillon, Ohio, has been given the contract for the steel.

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THE IRON AGE

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A Record Growth in Steel Capacity

Two distinctions belong to the year 1913 in the iron trade, for which it is apt to be less remembered than for the plunge into depression that came near its close. One is the new record it made for output, as represented by close to 31,000,000 tons of pig iron, probably 32,500,000 tons of steel ingots, and a 50,000,000-ton movement of Lake Superior iron ore. The other is the fact that much more new steel capacity was completed in the year just ended than in any that preceded. The details found elsewhere, of the new open-hearth plant added last year give a total of 51 furnaces with annual capacity of about 2,900,000 tons. They also show that 46 more open-hearth furnaces are now under construction, which will have a total capacity of 2,500,000 tons. Nowhere apart from the American steel industry could there be found such a complete reversal as this record of new construction shows, from the belief common in the trade so recently as the early part of 1912, that several years would be required for the development of a demand sufficient to absorb the then existing excess of steel-making capacity.

It is especially noteworthy that so large an addition of steel plant has been made in a year in which not a single new coke blast furnace was projected in the entire country. Three new steel works furnaces, with a capacity of 450,000 tons a year, were blown in last year, and one other of 150,000 tons capacity was completed; but to have more than 5,000,000 tons of new steel capacity completed or projected, with so little accompanying blast furnace construction, emphasizes strongly the passing of pig iron as a measure of the country's steel industry. The past two years have shown in a marked way the increasing extent to which scrap is figuring in steel production, even with the larger use of the duplex process. The country's growing scrap pile—which may be reckoned as an above-ground ore supply—is bound to be heard from as year after year more than 20,000,000 tons of finished steel products are put into use.

The relation of the new steel plant finished in 1913 to steel market conditions in the coming year is a phase of the subject which it was not the intention to discuss in this connection. It may be said, however, that a good deal of the new plant did not come into commission until signs of recession were in the air. Some of it was really the substitution of open hearth for Bessemer capacity, but it was Bessemer capacity which the shift to open-hearth steel had made largely inactive. Of the 2,500,000 tons of open-hearth capacity now under construction nearly one-half could be made ready for operation in the early months of 1914; a large part of the remainder is likely to go over to the latter part of this year or to 1915. Even so, the amount of steel plant available to meet the next buying movement when it comes suggests the maintenance of a moderate price level quite in contrast with some of the spectacular advances of 1912.

The Field of Lake Front Furnaces

The reported appearance of Buffalo pig iron in the Pittsburgh market in competition with the Mahoning and Shenango valley product is not as surprising as would appear at first glance. The lake front furnaces are relatively new and having had good consumptive demand in their immediate territory they have had little occasion to go afield and try conclusions with certain of the older districts. When competition becomes keen, new dividing lines between districts are frequently developed. Some time ago Cleveland furnaces made competitive quotations in the Pittsburgh district, but no regular flow of pig iron was established. Buffalo iron presents a more extreme case.

Upon the ore necessary to make a ton of pig the Valley furnaces must pay about $1.10 freight, an amount which is saved by the lake front furnaces. The other freight differences, on coke and pig iron, are against the latter. Coke rates from Connellsville are $1.20 to the valleys, $1.65 to Cleveland and $1.85 to Buffalo, while pig iron rates to Pittsburgh are 90 cents from the valleys, $1.40 from Cleveland and $1.75 from Buffalo.

Assuming roughly one ton of coke per ton of pig iron, the Cleveland furnace has a disadvantage of 45 cents on coke, thus assembling its raw materials 65 cents cheaper than the valley furnace; and paying 50 cents more on pig iron to Pittsburgh it still has an apparent advantage of 15 cents per ton of pig iron.

The Buffalo furnace, saving $1.10 on ore, pays theoretically 65 cents more on coke, thus having an advantage of 45 cents on raw materials, while in the pig iron freight it has 85 cents disadvantage, the net outcome being a disadvantage of 40 cents. The Buffalo furnaces, however, do not use Connellsville coke exclusively, but have some coke nearer at hand,

with probably lower first cost and slightly lower freight rates, so that they are in position to reduce their apparent disadvantage.

As a matter of fact it would appear that Pittsburgh, Valley, Cleveland and Buffalo furnaces have collectively small advantages or disadvantages, as purveyors to the Pittsburgh market, on account of differences in freights on coke, ore and pig iron. In a strongly competitive market the final test of competition is the ownership of ore, whether the merchant furnace has its own ore supply and can resign a part of its nominal ore profit in order to dispose of the ore in the form of pig iron.

Does Welfare Work Pay?

It is no new suggestion that of the welfare work now carried out at so many plants as much is inspired by selfish interest as by altruistic motives. Concerning the latter little need be said, for altruism pays even when it fails. But the endeavor to improve the condition of employees when made in the interest of better shop organization, increased production and higher quality of output at lower costs, is a purely economic question and is adjudged a success or failure in accordance with the results obtained. There need be no confusion of the two, and what seem like failures in welfare work where the foundation is self-interest may be due to the fact that the employee least of all is deceived. There is no doubt that a large question has arisen in the minds of many employers, whether a shop environment limited to the necessary conveniences and intercommunication is not better after all. In the case of the plant of moderate size, located in a small community, where the employee can be encouraged to establish a permanent home and where his co-workers in the plant are his neighbors and associates outside of working hours, the provision of unusual privileges does contribute doubtless to the permanency of the shop organization and to a closer relation between employer and employee. In the larger labor markets, where the situation develops a keen competition for men, where a dozen plants are almost equally accessible and where trade unionism is strongest, the tracing of more efficient plant-operation to welfare work is much more difficult and often impossible.

The abandonment or curtailment of welfare work in a number of prominent instances gives point to the question, Does it pay? Does the average workman in the shop, particularly where the less skilled and union operators predominate, recognize in those privileges which mean higher standards of personal hygiene and comfort considerations which affect the desirability of his job and which have weight really comparable with the primary fact of a good wage for a day's work? Do those plans which invite suggestion from employees, which provide special conveniences, entertainment and education under the auspices of the works, really take hold of the workman and create in him a sense of being well treated? Many experiences may be cited which answer in the negative.

Despite this lack of success from one standpoint, manufacturers naturally are constantly in search of plans for increasing efficiency, in the adoption of which the men will eagerly cooperate and to their own advantage. It is not too much to hope that some of the prejudice and distrust which is so characteristic of the shop man may be dispelled, if the right avenues of approach are used. In this connection the plan started by the Ford Motor Company in October is interesting, as described elsewhere in this issue. It has in it large possibilities for encouraging the men to their own betterment and to a provident manner of living. Its prospect of success lies in the fact that it makes its appeal along with the fundamental one of the most money for a day's work. At this date it seems to be accomplishing rather surprising results.

The Year in Industrial Engineering

Viewed at close range, the twelve months just ended appear to be signalized by noteworthy developments in industrial engineering. Pulverized coal has been given special study to widen its use beyond the cement-making plant. The feasibility of applying the waste-heat boiler, not only to heating processes of the ordinary sort, but to metallurgical furnaces, has been revived. The idea has been well germinated that the next big step in steam-generating economy lies in consideration of the man behind the coal shovel. Heat treatment of structure steels has become still more widely established, not merely as important but as essential. And not the least conspicuous of the movements are those having to do with safeguarding life, with minimizing useless effort, with relieving unfortunates of the burdens of industrial accidents and with the rewarding of those rendering efficient and trustworthy service. It is not that 1913 saw the birth of these developments, but a decided forward impetus in some cases and a regeneration in others.

Expressed in another way, the past year has made more of a factor of the mechanical engineer. He has had increased his manifold problems, particularly as works executive. As the one responsible for equipment, he has, through increasing costs of fuel, found it desirable to work to keep down power and heat costs, and, through exacting demands on the manufactured product in service, has had to keep in touch with the apparatus and methods employed to govern accurately the production of the desired article. As the one responsible for the esprit de corps of the working force, he has had to be alive to the demand to make the workman more efficient and has felt his obligation, suggested in increasing numbers by the employer, to make the shop as pleasant, safe and sanitary as possible.

Classed in another way, the problems have been engineering, managerial and sociological. Increasing cost of oil fuel had most to do with the adaptation of the final successes of powdered coal in the cement kiln to the requirements of other industrial processes. The year 1914 will undoubtedly bring out much of interest in this regard, but incidentally there are signs that oil burning is also to be pushed to gain ground that has apparently been lost. It is undoubtedly due also to high fuel costs that the long dormant waste-heat boiler has again been placed in the spot light, and much will probably be heard of this, including its utilization of waste gases of the gas engine. Scientific management is largely re-

sponsible of course for focusing on boiler-room labor and the futility of high-class apparatus with no intelligence in using it. It is also to be credited with a movement yet in its infancy having for its object the elimination of unnecessary fatigue of the worker, not alone as a result of motion studies, but by the provision of devices, appliances, seats, foot rests and the like which are calculated to save the body from shock, local muscular tension and energy expenditure without useful result. Perhaps as striking as any of the changes in conditions is the truly remarkable consideration being given to the human element. The employer is taking thought of the employee's welfare even beyond the shop, and the wonder of it is the workman is seemingly recognizing a new era of things and does not object.

Prices Under the New Tariff

A Pittsburgh correspondent of the New York Evening Post makes the following suggestive statement regarding the bearing on domestic iron and steel prices of the lowered duties in the new tariff:

> There is a possibility that the tariff will have a curious and unexpected effect upon iron and steel prices. Our prices have been falling for some time, and the question was when and at what level the bottom would be found. Today it is the common talk in the steel trade that the reduced tariff will prevent any great advances in our prices in future, and that hence it is important that prices be kept from falling very low at this time. In the past, it is suggested, producers of steel and iron frequently started an advance by "getting under the market" so as to push it up, hoping eventually by the advance to attain a fair average. If, however, high prices are not eventually to be realized, it is the more important to prevent them from becoming particularly low at present.

This view of the situation agrees in part with our own observations. For some time our market reports have been recording the resistance by manufacturers of various products of overtures from large consumers desiring to place long term contracts at present prices. These manufacturers have shown decided determination not to repeat the performance of 1912 when they booked heavy contracts for forward delivery at prices which were exceptionally favorable to the buyers. The subsequent rapid advance in prices, with the payment of high premiums by needy buyers to those manufacturers who were able to fill in orders for prompt delivery, is probably too fresh in the recollection of iron and steel manufacturers for them to take the chance of repeating such a mistake in selling. The leading steel companies especially loaded themselves with so much business at the lowest prices of that time of scrambling for orders that much material was still being delivered on those old contracts up to the third quarter of last year.

A great opportunity was thus lost of reaping much benefit from the unprecedented demand for steel products which marked the opening months of 1913. The manufacturers who refuse to make contracts for far forward delivery at or below present prices can hardly fail to profit in the long run by adhering to the policy of selling for not more than three months ahead. By that time the situation will have cleared and it will be seen whether, as now seems probable, this period of underconsumption shall not have given way to a volume of business more in consonance with the requirements of this growing country.

Issue can well be taken, however, with the expression in the above extract "that the reduced tariff will prevent any great advances in our prices in future." This is evidently founded on the erroneous belief that foreign iron and steel prices are always low and that a level is thus fixed above which there can be no expectation of American prices rising as long as duties remain as recently enacted. That this is a mistaken view needs no further proof than a reference to the condition of affairs in foreign iron and steel markets in 1912. The demand abroad was then so heavy as to lift European prices to a hight that permitted American manufacturers to sell certain steel products in neutral markets at better prices than were to be obtained at home.

That such conditions can again occur is not only to be expected but it is entirely within the range of reasonable probability that they may occur in the near future. It must be borne in mind that the world's iron and steel requirements are steadily growing and that the only countries in which adequate additions to steel-producing capacity are being made are Germany and the United States. Other steel-producing countries can make themselves felt in times of depression and underconsumption, but when the general demand for steel again improves throughout the world, as it surely must at a reasonably early day, the output of the smaller producing countries will be easily absorbed, Germany will again have all it can do to take care of its home and export trade and European iron and steel will not be cheap. The low tariff may keep our prices down when iron and steel prices are depressed in Europe, but that is by no means a permanent condition.

Milliken Brothers, Inc., Reorganized.

The reorganization of Milliken Brothers, Inc., to which reference has been made in *The Iron Age* recently, has been completed and most of its properties have been assigned to a new organization bearing the same name and incorporated under the laws of Virginia. The new company has a capitalization of $3,000,000 non-cumulative preferred stock and $1,500,000 of common stock and there is no mortgage on the property. Fresh capital was raised partly by assessing bondholders and partly by selling to the Bethlehem Steel Corporation, for about $300,000, a portion of the rolling mill property of the company on Staten Island. It is stated by an officer of the company that it will have a working capital of approximately $1,000,000. William Salomon, of William Salomon & Co., will act as president until his successor can be chosen, with Francis Dykes, vice-president, in charge of operation. George E. Barrett is secretary and A. A. Cannon, treasurer. The directors are Jules S. Bache, William Salomon, William L. Saunders, William B. Parsons, Thomas Denny, C. McKay Lewis, Frederick G. Corning, Cornelius B. Tyler and Francis Dykes.

A new aluminum alloy, consisting of 60 parts aluminum, 20 parts zinc, 16½ parts silver and 5 parts copper has been patented by William A. McAdams, Bay Shore, N. Y. It is claimed to be well adapted for casting, to be resonant, and to have a permanent luster.

Union Switch & Signal Company's Dividends

In December, 1910, the Union Switch & Signal Company, Pittsburgh, increased its capital stock from $2,000,000 to $4,500,000, and a stock dividend of 60 per cent. was declared. In December, 1912, it declared a stock dividend of 10 per cent. in addition to the regular quarterly dividend in cash. From December, 1906, when the annual cash dividend rate was raised to 12 per cent., down to date, the company has paid $6 a share each year on both common and preferred stock. A meeting is called for March 14 to vote on an increase in the authorized capital stock from $5,000,000 to $10,000,000, and immediately thereafter the directors are expected to declare a stock dividend of 33 1-3 per cent. The remainder of the increased stock will go into the treasury of the company for future purposes.

The Medart Patent Pulley Company, St. Louis, Mo., organized in 1879, and operated under a copartnership agreement by Philip and William Medart, is now incorporated with the following as members: Florence Mueller Medart (of Stuttgart, Germany) and Kate Medart (of Paris, France), 583 shares each; Josephine Mulhall, 583 shares; William F. Mulhall, 1 share; Elise Medart and Walter R. Medart, 875 shares each. It will manufacture power transmission machinery, etc. Elise and Walter R. Medart are heirs of Philip Medart, who died three years ago. The others are heirs of William Medart, who died last October. The officers are: Walter R. Medart, president and treasurer; William F. Mulhall, secretary. Board of directors, Walter R. Medart, Elise Medart and William F. Mulhall. The capital stock, fully paid, is $350,000, with a voluntary surplus of $52,000.

Strong efforts are being made by the business interests of Steubenville, Ohio, to settle the long strike at the Pope works of the Phillips Sheet & Tin Plate Company. The plant has been closed on account of the refusal of the company to sign the Amalgamated scale of wages. At a recent meeting the company stated it would take back old employees, but will run the plant open shop. It is said that the company has received strong inducements to locate the mill elsewhere, and has been promised protection, in case of removal, in operating the plant open shop.

A complete census of the number of motor vehicles in the world was compiled for the first time for the International Road Congress recently held in London. It shows that the United States possesses more than one-half of all motor vehicles, including motorcycles, in the world, the total number for the United States being 628,185. England comes next with 125,728, France with 89,185, and Germany with 70,006. The total number of motor trucks in the world is stated to be 69,556. The automobiles, of course, exceed greatly the number of trucks.

The Bureau of Standards, Washington, D. C., has recently issued circular No. 45 on "The Testing of Materials." It is designed to furnish information on some of the general aspects of this branch of the bureau's work, and is intended more for the user or buyer than the industrial expert. Every important industry is covered. A scale of prices at which the bureau can perform the testing is furnished.

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The Standard Tank Works, Chicago, Ill., manufacturer of gasoline and oil storage systems, has perfected plans for a new concrete and steel building, 60 x 120 ft., which it expects to occupy by March 1. The building will be equipped with a 15-ton traveling crane and the company desires to receive catalogues from manufacturers of engines, boilers, machine tools and supplies to aid in the selection of equipment.

A new foundry was recently started in Byesville, Ohio, by the Byesville Machine & Foundry Company. The company does general foundry work in both iron and brass, and is also prepared to do general machine shop work. T. W. Scott is president, C. C. Cosgrove secretary, A. J. True treasurer and Karl M. Garner manager.

The Iron and Metal Markets

SOME LARGE RAIL SALES

The Status of Finished Material Prices

Activity in Cast Iron Pipe—Buying of Steel-Making Pig Iron

The steel trade finds much that obscures the outlook, as it comes into 1914; yet there is the feeling that some of the unfavorable factors have already shown their largest capacity for harm. The worldwide tightness in money with its constriction of industry is one of these. Another set of causes, purely domestic and partly political, while still confusing, shows some brighter aspects. In the third place is the condition in the steel trade itself, created by the decline of the market below the prices at which many hundred thousand tons of contract business was put on steel company books. This has exaggerated what is largely the waiting of buyers for lower prices to the aspect of a marked decline in consumption.

It is not yet clear how much consumption has suffered. Building has fallen off. Not only has railroad buying been cut down, but the railroad use of iron and steel. Foundries are slacker, because equipment for extensions is not being bought. But there have been signs in the last week of 1913 of more interest by buyers of both pig iron and finished steel.

Two trunk lines have contracted for a total of 170,000 tons of rails (120,000 and 50,000 tons), nearly all the mills participating. The Lackawanna is also reported to have bought in part and there are 300,000 tons of rails under inquiry for the Atchison, the Southern Railway, the Union Pacific and other lines. It has been expected that the Union Pacific order for 5000 cars would be closed this week, bringing the total for 1913 up to 110,000 cars, against 230,000 placed in 1912.

The extensive shut-downs over the holidays have given the industry an appearance of extreme quietness; but there have been some exceptions, as in sheet and tin plate mill operations. The Steel Corporation's tin plate mills are operating this week at 85 per cent. of capacity and its sheet mills at 65 per cent. Sheet bar specifications for January indicate that independent mills also will be busier than for several weeks.

The efforts of buyers to catch the market at low point have appeared here and there, but there has not been the expected weakening of plate, shape and bar prices. There is less shading of the 1.20c. basis for early shipments of bars and shapes, and on first quarter business some large interests are quoting 1.25c.

In cast iron pipe, after a long period of dullness, good sized inquiries have come out. Troy, N. Y., will open bids for 6100 tons of 30-in., and Worcester, Mass., for 3800 tons of 36-in. on January 2, and on January 3 Chicago will open bids on 12,000 tons of 8 to 18-in. Indianapolis has just taken 5000 tons and St. Paul will buy 4000 tons.

Pig iron buying at low prices, under quiet negotiations, is believed to have been larger in December than was generally known. Some special concessions were made in certain Central Western business where sellers went out of their usual territory. One or two large foundry interests are about closing this week. At New Jersey and eastern Pennsylvania points a lower level has been reached in the competition of lake front and Eastern furnaces.

An Ohio River steel plant is inquiring for 20,000 tons of basic iron for the first half. At Pittsburgh, a sale of 8000 to 10,000 tons of basic for first quarter was made at $12.60, valley furnace, while prompt basic sold at $12.50. Bessemer iron has sold down to $14.25 at furnace.

There has been large buying of blast furnace coke in the Central West at $1.85 to $2 at oven for the first half of the year. The firmness of some makers in holding for $2 is in the face of the scheduled blowing out of three valley furnaces and the announcement of one interest that its five furnaces would go out because of high coke and low pig iron.

A Comparison of Prices

Advances Over the Previous Week in Heavy Type, Declines in Italics

At date, one week, one month, and one year previous.

	Dec. 31, 1913.	Dec. 24, 1913.	Dec. 3, 1913.	Jan. 1, 1913.
Pig Iron, Per Gross Ton:				
No. 2 X, Philadelphia...	$15.00	$15.00	$15.50	$18.50
No. 2, Valley furnace....	13.00	13.00	13.50	17.50
No. 2 Southern, Cin'ti...	13.75	13.75	14.25	17.25
No. 2, Birmingham, Ala..	10.50	10.50	11.00	14.00
No. 2, furnace, Chicago*.	14.00	14.00	14.75	18.00
Basic, del'd, eastern Pa..	*14.00*	14.25	15.00	18.25
Basic, Valley furnace....	*12.50*	12.75	12.75	16.50
Bessemer, Pittsburgh....	*15.15*	15.90	15.90	18.15
Malleable Bess., Ch'go*..	14.50	14.50	14.75	18.00
Gray forge, Pittsburgh..	13.90	13.90	14.15	17.15
L. S. charcoal, Chicago..	15.25	15.25	15.25	18.75
Billets, etc., Per Gross Ton:				
Bess. billets, Pittsburgh..	20.00	20.00	20.00	27.50
O.-h. billets, Pittsburgh..	20.00	20.00	20.00	28.50
O.-h. sheet bars, P'gh....	21.00	21.00	21.00	29.00
Forging billets, P'gh.....	24.00	24.00	24.00	35.00
O.-h. billets, Phila.....	*21.50*	22.40	22.50	32.00
Wire rods, Pittsburgh....	25.00	25.00	25.50	30.00
Old Material, Per Gross Ton:				
Iron rails, Chicago	13.00	13.00	13.50	17.25
Iron rails, Phila.....	15.50	15.50	17.00	18.00
Carwheels, Chicago	11.50	11.50	12.00	17.25
Carwheels, Philadelphia..	12.00	12.00	12.00	16.00
Heavy steel scrap, P'gh..	*10.50*	10.75	11.25	15.00
Heavy steel scrap, Phila..	10.00	10.00	10.00	14.50
Heavy steel scrap, Ch'go.	9.00	9.00	9.00	12.50
No. 1 cast, Pittsburgh...	10.75	12.00	12.00	14.50
No. 1 cast, Philadelphia.	12.00	12.00	12.50	15.00
No. 1 cast, Ch'go (net ton)	10.00	10.00	10.00	13.00
Finished Iron and Steel,				
Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Bess. rails, heavy, at mill	1.25	1.25	1.25	1.25
Iron bars, Philadelphia..	1.22½	1.22½	1.25	1.67½
Iron bars, Pittsburgh....	1.35	1.35	1.35	1.70
Iron bars, Chicago	1.10	1.10	1.15	1.57½
Steel bars, Pittsburgh...	1.20	1.20	1.25	1.70
Steel bars, New York....	1.36	1.36	1.41	1.86
Tank plates, Pittsburgh..	1.20	1.20	1.20	1.75
Tank plates, New York..	1.36	1.36	1.36	1.91
Beams, etc., Pittsburgh..	1.20	1.20	1.25	1.75
Beams, etc., New York...	1.31	1.31	1.41	1.91
Skelp, grooved steel, P'gh	1.20	1.20	1.25	1.45
Skelp, sheared steel, P'gh	1.30	1.30	1.35	1.50
Steel hoops, Pittsburgh..	1.35	1.35	1.45	1.50
Sheets, Nails and Wire,				
Per Lb. to Large Buyers:				
Sheets, black, No. 28, P'gh	*1.85*	1.90	1.90	2.25
Galv. sheets, No. 28, P'gh	*2.85*	2.90	2.90	3.40
Wire nails, Pittsburgh...	1.55	1.55	1.55	1.75
Cut nails, f.o.b. East'n mills	1.65	1.65	1.65	1.75
Cut nails, Pittsburgh....	1.55	1.55	1.55	1.70
Fence wire, base, P'gh...	1.35	1.35	1.35	1.55
Barb wire, galv., P'gh...	1.95	1.95	1.95	2.15

*The average switching charge for delivery to foundries in the Chicago district is 50c. per ton.

Coke, **Connellsville,**

Per Net Ton at Oven:	Dec. 31, 1913.	Dec. 24, 1913.	Dec. 3, 1913.	Jan. 1, 1913.
Furnace coke, prompt	$1.85	$1.75	$1.75	$4.15
Furnace coke, future	2.00	1.85	1.85	3.25
Foundry coke, prompt	2.50	2.50	2.50	4.50
Foundry coke, future	2.60	2.60	2.75	4.00

Metals,

Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Lake copper, New York	15.12½	14.62½	15.00	17.75
Electrolytic copper, N. Y.	14.87½	14.37½	14.62½	17.62½
Spelter, St. Louis	5.20	5.00	5.00	7.15
Spelter, New York	5.35	5.15	5.15	7.30
Lead, St. Louis	4.10	3.95	3.95	4.15
Lead, New York	4.15	4.10	4.10	4.30
Tin, New York	37.37½	36.65	38.50	50.65
Antimony, Hallett's, N. Y.	7.00	7.00	7.10	9.50
Tin plate, 100-lb. box, P'gh.	$3.40	$3.40	$3.40	$3.60

Finished Iron and Steel f. o. b. Pittsburgh

Freight rates from Pittsburgh, in carloads, per 100 lb., New York, 16c.; Philadelphia, 15c.; Boston, 18c.; Buffalo, 11c.; Cleveland, 10c.; Cincinnati, 15c.; Indianapolis, 17c.; Chicago, 18c.; St. Louis, 22½c.; Kansas City, 42½c.; Omaha, 42½c.; St. Paul, 32c.; Denver, 84½c.; New Orleans, 30c.; Birmingham, Ala., 45c.; Pacific coast, 80c. on plates, structural shapes and sheets No. 11 and heavier, 85c. on sheets Nos. 12 to 16; 95c. on sheets No. 16 and lighter; 65c. on wrought pipe and boiler tubes.

Plates.—Tank plates, ¼ in. thick, 6¼ in. up to 100 in. wide, 1.20c., base, net cash, 30 days. Following are stipulations prescribed by manufacturers with extras:

Rectangular plates, tank steel or conforming to manufacturer's standard specifications for structural steel dated February 6, 1903, or equivalent, ¼ in. and over on thinnest edge, 100 in. wide and under, down to but not including 6 in. wide, are base.

Plates up to 72 in. wide, inclusive, ordered 10.2 lb. per sq. ft., are considered ¼-in. plates. Plates over 72 in. wide must be ordered ¼ in. thick on edge, or not less than 11 lb. per sq. ft., to take base price. Plates over 72 in. wide ordered less than 11 lb. per sq. ft. down to the weight of 3-16 in. take the price of 3-16 in.

Allowable overweight, whether plates are ordered to gauge or weight, to be governed by the standard specifications of the Association of American Steel Manufacturers.

Extras.	Cents per lb.
Gauges under ¼ in. to and including 3-16 in.	.10
Gauges under 3-16 in. to and including No. 8	.15
Gauges under No. 8 to and including No. 9	.25
Gauges under No. 9 to and including No. 10	.30
Gauges under No. 10 to and including No. 12	.40
Sketches (including straight taper plates) 3 ft. and over	.10
Complete circles 3 ft. in diameter and over	.20
Boiler and flange steel	.10
"A. B. M. A." and ordinary firebox steel	.20
Still bottom steel	.30
Marine steel	.40
Locomotive firebox steel	.50
Widths over 100 in. up to 110 in., inclusive	.05
Widths over 110 in. up to 115 in., inclusive	.10
Widths over 115 in. up to 120 in., inclusive	.15
Widths over 120 in. up to 125 in., inclusive	.25
Widths over 125 in. up to 130 in., inclusive	.50
Widths over 130 in.	1.00
Cutting to lengths, under 3 ft., to 2 ft. inclusive	.25
Cutting to lengths, under 2 ft., to 1 ft inclusive	.50
Cutting to lengths, under 1 ft.	1.55

No charge for cutting rectangular plates to lengths 3 ft. and over.

Structural Material.—I-beams, 3 to 15 in.; channels, 3 to 15 in.; angles, 3 to 6 in. on one or both legs, ¼ in. thick and over, and zees, 3 in. and over, 1.20c. to 1.25c. Extras on other shapes and sizes are as follows:

	Cents per lb.
I-beams over 15 in.	.10
H-beams over 18 in.	.10
Angles over 6 in. on one or both legs	.10
Angles, 3 in. on one or both legs, less than ¼ in. thick as per steel bar card, Sept. 1, 1909	.70
Tees, structural sizes (except elevator, hand rail, car-truck and conductor rail)	.05
Channels and tees, under 3 in. wide, as per steel bar card, Sept. 1, 1909	.20 to .80
Deck beams and bulb angles	.30
Hand rail tees	.75
Cutting to lengths, under 3 ft., to 2 ft. inclusive	.25
Cutting to lengths, under 2 ft., to 1 ft. inclusive	.50
Cutting to lengths, under 1 ft.	1.55

No charge for cutting to lengths 3 ft. and over.

Wire Rods.—Bessemer, open-hearth and chain rods, $25 to $25.50.

Wire Products.—Fence wire, Nos. 0 to 9, per 100 lb., terms 60 days or 2 per cent. discount in 10 days, carload lots to jobbers, annealed, $1.35; galvanized, $1.75. Galvanized barb wire and fence staples, to jobbers, $1.95; painted, $1.55. Wire nails, to jobbers, $1.55. Prices of the foregoing wire products to dealers, in carload lots, are 5c. higher. Woven wire fencing, 74½ per cent. off list for carloads; 73½ off for 1000-rod lots; 72½ off for less than 1000-rod lots.

Wrought Pipe.—The following are the jobbers' carload discounts on the Pittsburgh basing card on steel pipe in effect from October 27, 1913, and iron pipe from June 2, 1913, all full weight:

Butt Weld.

Steel. Inches.	Black	Galv.	Iron. Inches.	Black	Galv.
⅛, ¼ and ⅜	73	52½	⅛ and ¼	66	47
½	77	66½	⅜	65	46
¾ to 3	80	71½	½	69	56
			¾ to 2½	72	61

Lap Weld.

2	77	68½	1¼	56	45
2½ to 6	79	70½	1½	67	56
7 to 12	76	65½	2	68	58
13 to 15	53	....	2½ to 4	70	61
			4½ to 6	70	61
			7 to 12	68	55

Reamed and Drifted.

1 to 3, butt	78	69½	1 to 1½, butt	70	59
2, lap	75	66½	2, butt	70	59
2½ to 6, lap	77	68½	1¼, lap	54	43
			1½, lap	65	54
			2, lap	66	56
			2½ to 4, lap	68	59

Butt Weld, extra strong, plain ends.

⅛, ¼ and ⅜	68	57½	⅜	63	52
½	73	66½	½	67	60
¾ to 1½	77	70½	¾ to 1½	71	62
2 to 3	78	71½	2 and 2½	72	63

Lap Weld, extra strong, plain ends.

2	74	65½	1½	65	59
2½ to 4	76	67½	2	66	58
4½ to 6	75	66½	2½ to 4	70	61
7 to 8	68	57½	4½ to 6	69	60
9 to 12	63	52½	7 and 8	63	53
			9 to 12	58	47

Butt Weld, double extra strong, plain ends.

½	63	56½	½	57	49
¾ to 1½	66	59½	¾ to 1½	60	52
2 to 2½	68	61½	2 and 2½	63	54

Lap Weld, double extra strong, plain ends.

2	64	57½	2	55	49
2½ to 4	66	59½	2½ to 4	60	54
4½ to 6	65	58½	4½ to 6	59	53
7 to 8	58	47½	7 to 8	52	42

To the large jobbing trade an additional 5 and 2½ per cent. is allowed over the above discounts.

Boiler Tubes.—Discounts to jobbers, in carloads on lap-welded steel, in effect from May 29, 1913, and standard charcoal-iron boiler tubes, in effect from January 1, 1913, are as follows:

Lap-Welded Steel.		*Standard Charcoal Iron.*	
1¾ and 2 in.	60	1½ in.	44
2¼ in.	57	1¾ and 2 in.	48
2½ and 2¾ in.	63	2¼ in.	44
3 and 3¼ in.	67	2½ to 2¾ in.	53
3½ to 4½ in.	69	3 and 3¼ in.	55
5 and 6 in.	63	3½ to 4½ in.	58
7 to 13 in.	60		

Locomotive and steamship special grades bring higher prices.

Sheets.—Makers' prices for mi.. shipment on sheets of U. S. Standard gauge, in carload and larger lots, on which jobbers charge the usual advance for small lots from store, are as follows, f.o.b. Pittsburgh, terms 30 days net or 2 per cent. cash discount in 10 days from date of invoice:

Blue Annealed Sheets.

	Cents per lb.
Nos. 3 to 8	1.40 to 1.45
Nos. 9 and 10	1.45 to 1.50
Nos. 11 and 12	1.50 to 1.60
Nos. 13 and 14	1.55 to 1.65
Nos. 15 and 16	1.65 to 1.70

Box Annealed Sheets, Cold Rolled.

Nos. 10 and 11	1.50 to 1.60
No. 12	1.50 to 1.60
Nos. 13 and 14	1.55 to 1.65
Nos. 15 and 16	1.60 to 1.70
Nos. 17 to 21	1.65 to 1.75
Nos. 22 and 24	1.70 to 1.80
Nos. 25 and 26	1.75 to 1.85
No. 27	1.80 to 1.90
No. 28	1.85 to 1.95
No. 29	1.90 to 2.00
No. 30	2.00 to 2.10

Galvanized Sheets of Black Sheet Gauge.

Nos. 10 and 11	1.85 to 1.95
No. 12	1.95 to 2.05
Nos. 13 and 14	1.95 to 2.05
Nos. 15 and 16	2.10 to 2.20
Nos. 17 to 21	2.25 to 2.35
Nos. 22 and 24	2.40 to 2.50
Nos. 25 and 26	2.55 to 2.65
No. 27	2.70 to 2.80
No. 28	2.85 to 2.95
No. 29	3.00 to 3.10
No. 30	3.15 to 3.25

Pittsburgh

PITTSBURGH, PA., December 29, 1913.

The last week of the year finds the steel trade slightly more active, consumers taking more interest. The long period of inactivity in Bessemer pig iron has been broken. Some heavy business in coke has been closed. The opinion is general that a fairly good buying movement will take place early in January. Prices are regarded as having about touched bottom, and the question now between seller and consumer is how far ahead sellers will make contracts for finished iron and steel at present prices.

Pig Iron.—The monotony in the Bessemer pig-iron trade has been broken and sales of several fair-sized lots for first quarter delivery have been made at $14.25 to $14.50, Valley furnace. More has been offered for first quarter at $14.25, and declined. A good deal of basic has been sold for first quarter at about $12.60, Valley furnace. The Andrews Steel Company, Newport, Ky., is inquiring for 20,000 tons of basic for first half. The N. & G. Taylor Company, Philadelphia, has not yet closed for the 2400 tons of basic for its open-hearth works at Cumberland, Md. Alice furnace, of the Valley Mold & Foundry Company, whose product this year was sold by W. P. Snyder & Co., is being blown out today. Two, and possibly three, Youngstown furnaces will be blown out shortly, and a large Cleveland furnace interest is said to have decided to blow out five. The Standard Sanitary Mfg. Company has not yet closed on its inquiry for 4000 tons of Northern foundry iron. We note sales of 3000 to 4000 tons of standard Bessemer iron at $14.25, Valley furnace; 3000 to 4000 tons of Bessemer made last week at about $14.50; 500 tons of prompt basic at $12.50 and 8000 to 10,000 tons for first quarter at about $12.60, Valley furnace. We quote standard Bessemer iron at $14.25; basic, $12.50 for prompt and $12.60 for first quarter; No. 2 foundry, $13; malleable Bessemer, $12.75, and gray forge nominally at $13, all at Valley furnace, freight rate for delivery in the Pittsburgh or Cleveland district being 90c. per ton.

Billets and Sheet Bars.—Quite a heavy tonnage of Bessemer and open-hearth sheet bars has been sold for first quarter and first half delivery at $21, maker's mill, Pittsburgh or Youngstown. We also note a sale of 6000 tons of Bessemer sheet bars for first quarter at $21.80, maker's mill, the buyer paying a premium to get Bessemer. We quote Bessemer and open-hearth billets at $20 and Bessemer and open-hearth sheet bars at $21, maker's mill, Pittsburgh or Youngstown. We quote forging billets at $24 and axle billets $23, Pittsburgh.

Muck Bar.—Best grades, made from all pig iron, are quoted nominally at $29, Pittsburgh.

Steel Rails.—The Carnegie Steel Company has been asked by several leading Eastern trunk lines to reserve rolling space for standard sections in the first half of 1914 and some large contracts are expected to come out early in January. The company received new orders and specifications for light rails the past week aggregating about 2300 tons. We quote splice bars at 1.50c. and standard section rails at 1.25c. Light rails, rolled from billets, are quoted as follows: 25, 30, 35, 40 and 45 lb. sections, 1.25c.; 16 and 20 lb., 1.30c.; 12 and 14 lb., 1.35c. and 8 and 10 lb., 1.40c., all in carload lots, f.o.b. Pittsburgh.

Plates.—The demand is dull. No further orders for steel cars have been placed. The car builders are figuring on 5000 refrigerator cars for the Union Pacific, and this is about the only active inquiry out. We quote ¼-in. and heavier plates at 1.20c., for reasonably prompt shipment.

Wire Rods.—Specifications are quiet and new demand is light. We quote Bessemer, open-hearth and chain rods at $25, Pittsburgh, for desirable orders and $25.50 for small lots.

Structural Material.—No contracts of moment were placed with local fabricators in the past week, and inquiry is slack. We quote beams and channels up to 15 in. at 1.20c. for desirable orders and 1.25c. for small lots.

Ferroalloys.—It is understood that the Carnegie Steel Company is offering domestic 80 per cent. ferromanganese at about $47, Pittsburgh, for delivery over first half, this being the price of foreign at seaboard. The company has sold 1000 tons to the Republic Iron & Steel Company and 1500 tons to the American Steel Foundries, prices to be adjusted monthly. We quote domestic ferromanganese at $47 to $47.50, Pittsburgh, and foreign at $47, seaboard. The Carnegie Company has not yet closed on its requirements of ferrosilicon for 1914. We quote 50 per cent. ferrosilicon, in lots up to 100 tons, at $73; over 100 tons to 600 tons, $72; over 600 tons, $71, delivered in the Pittsburgh district. We quote 10 per cent. ferrosilicon at $21; 11 per cent., $22, and 12 per cent., $23, f.o.b. cars Jackson County, Ohio, or Ashland, Ky., furnaces. We quote 20 per cent. spiegeleisen at $25 at furnace. We quote ferrotitanium at 8c. per lb. in carloads; 10c. in 2000-lb. lots and over, and 12½c. in less than 2000-lb. lots

Skelp.—The market is strong, the mills being pretty well filled for several months. We quote grooved steel skelp at 1.20c. to 1.25c.; sheared steel skelp, 1.30c. to 1.35c.; grooved iron skelp, 1.55c. to 1.60c.; and sheared iron skelp at 1.60c. to 1.65c., Pittsburgh.

Iron and Steel Bars.—A good deal of business is being placed in reinforcement bars but the general demand for both iron and steel bars is quiet. The Carnegie Steel Company has sold 2500 tons of reinforcement bars for a warehouse in Brooklyn, N. Y., and 2500 tons for another building in the same city. We quote steel bars at 1.20c. on desirable orders for first quarter delivery and common iron bars at 1.35c. to 1.40c., f.o.b., maker's mill, Pittsburgh.

Sheets.—Makers report a better demand. Jobbers are taking more interest in the market. While a few contracts for delivery through the first half have been placed at about 2c. for No. 28 Bessemer black and 3c. for No. 28 galvanized, it is said that fully 90 per cent. of the business now being taken by the mills is for delivery in 45 to 60 days. Specifications against contracts are better, and reports from sales managers all over the country indicate strongly a belief among the trade that prices have likely touched bottom. The minimum of the market on prompt specifications seems to be 1.85c. for No. 28 Bessemer black and 2.85c. for No. 28 galvanized, while on contracts from 1.95c. to 2c. is quoted on black and 2.95c. to 3c. on galvanized. Last week nearly all the sheet mills were closed, but many of them have again started, and operations are probably on about a 60 per cent. basis.

Tin Plate.—Practically all the tin-plate business for 1914 with large consumers is now under contract, and the mills report that specifications are coming in quite freely. Part of this business is stated to have been taken at prices which leave little margin of profit even to the best equipped mills. Many of the plants that closed last week are now running and it is believed that operations from this time on will be heavier. The openly quoted price of tin plate remains at $3.40 per box for 100-lb. cokes, but this is purely nominal and is obtained for only small lots.

Shafting.—There is a little better demand for prompt shipment. Some makers are refusing to enter contracts for long delivery at present prices, expecting a much better demand before long. We quote cold-rolled shafting in carload and larger lots at 64 to 65 per cent. off, and in small lots 62 to 63 per cent. off, delivered in base territory.

Bolts and Rivets.—The demand is still only for small lots to meet actual needs. Prices continue irregular. We quote button-head structural rivets at $1.70 and cone-head boiler rivets at $1.80 in carload lots, about $2 a ton advance over these prices being charged for small lots. Terms are 30 days, net, less 2 per cent. for cash in 10 days.

Hoops and Bands.—New business is light, and specifications against contracts are quiet. We quote steel bands at 1.20c. and hoops at 1.35c., maker's mill.

Wire Products.—The demand is only for small lots to meet current needs. Specifications against contracts are not expected until some time in January.

Prices are weak. Wire nails for delivery at some competitive points are being sold at $1.50 and plain wire as low as $1.30 at mill. We quote wire nails to jobbers at $1.55; cut nails, $1.55; plain annealed wire, $1.35; galvanized barb wire and fence staples, $1.95, and painted barb wire, $1.55, f.o.b. Pittsburgh, per 100 lb., usual terms, actual freight added to point of delivery. We quote woven wire fencing at 74½ per cent. off in carload lots; 73½ per cent. off on 1000-rod lots, and 72½ per cent. on less than 1000-rod lots, all f.o.b. Pittsburgh.

Railroad Spikes.—The railroad inquiry continues active. The Erie is asking for 10,000 kegs; Chicago, Burlington & Quincy, 25,000; Chicago & Eastern Illinois, 8000, while the Chicago, Milwaukee & St. Paul and the New York Central have inquiries out, but not for definite quantities. The outlook is better than for some months. On large contracts, railroad spikes have sold at $1.45, while on small lots $1.50 is quoted. We quote small railroad and boat spikes at $1.55 per 100 lb., f.o.b. Pittsburgh.

Merchant Steel.—The demand being quiet, prices are considerably shaded. Contracts have been pretty well cleaned up, and shipments by the mills are light. Nominal prices on small lots are as follows: Iron finished tire, ⅛ x 1½ in., and larger, 1.35c., base; under ½ x 1½ in., 1.50c.; planished tire, 1.55c.; channel tire, ¾ to ⅞ and 1 in., 1.85c. to 1.95c.; 1⅛ in. and larger, 1.95c.; toe calk, 1.95c. to 2.05c., base; flat sleigh shoe, 1.70c.; concave and convex, 1.75c.; cutter shoe, tapered or bent, 2.25c. to 2.35c.; spring steel, 1.95c. to 2.05c.; machinery steel, smooth finish, 1.80c. We quote cold-rolled strip steel as follows: Base rates for 1 in. and 1½ in. and wider, under 0.20 carbon, and No. 10 and heavier, hard temper, 3.25c.; soft, 3.50c.; coils, hard, 3.15c.; soft, 3.40c.; freight allowed. The usual differentials apply for lighter sizes.

Standard Pipe.—Business in both iron and steel standard pipe is better this late in the season than in former years. The mills are running to probably 75 per cent. of capacity. The Huntington Gas & Development Company, Huntington, W. Va., has placed 15 miles of 12-in. with a local mill for March delivery. It is said that discounts are well maintained.

Boiler Tubes.—Orders are light but several railroads are figuring on placing large orders for locomotives, and inquiries are expected for the tubes in a short time. Prices are weak.

Old Material.—The market is almost stagnant, as suspensions of shipments have been ordered for such consuming points as Steubenville, Monessen, Midland and Johnstown. Consumers are taking more interest in the market, however, and are expected to do some buying soon. Reports that borings and turnings have advanced about 50c. a ton are denied. Dealers are quoting about as follows per gross ton for delivery in the Pittsburgh and other districts:

Selected heavy steel scrap, Steubenville, Follansbee, Brackenridge, Sharon, Monessen, Midland and Pittsburgh delivery	$10.50 to $10.75
Compressed side and end sheet scrap	9.75 to 10.00
No. 1 foundry cast	10.75 to 11.00
No. 2 foundry cast	9.75 to 10.00
Bundled sheet scrap, f.o.b. consumers' mills, Pittsburgh district	6.50 to 6.75
Rerolling rails, Newark and Cambridge, Ohio, Cumberland, Md., and Franklin, Pa.	13.00 to 13.25
No. 1 railroad malleable stock	11.25 to 11.50
Grate bars	7.50 to 7.75
Low phosphorus melting stock	14.00 to 14.25
Iron car axles	24.25 to 24.75
Steel car axles	17.25 to 17.50
Locomotive axles, steel	20.75 to 21.25
Locomotive axles, iron	25.25 to 25.75
No. 1 busheling scrap	10.25 to 10.50
No. 2 busheling scrap	6.25 to 6.75
*Machine shop turnings	6.50 to 6.75
Old carwheels	11.50 to 11.75
*Cast-iron borings	7.25 to 7.50
†Sheet bar crop ends	13.50 to 13.75
Old iron rails	14.25 to 14.50
No. 1 railroad wrought scrap	13.50 to 13.75
Heavy steel axle turnings	8.75 to 9.00
Stove plate	7.50 to 7.75

*These prices are f.o.b. cars at consumers' mills in the Pittsburgh district.
†Shipping point.

Coke.—A considerable tonnage of strictly high grade furnace coke for January delivery has been closed at $2 per net ton at oven. A contract with a Youngstown consumer for 45,000 tons a month for first half will likely be closed in a day or two. Another Youngstown consumer has bought 10,000 to 12,000 tons of furnace coke per month for first half at $1.85 per net ton at oven, and an Eastern consumer has also bought about 30,000 tons a month for first half at $1.85. A Sharon furnace interest is in the market for 8000 tons per month for first half, and a Youngstown interest for 15,000 tons per month for first half. A sale of 12,000 tons of high grade furnace coke for January delivery has been made to a Valley furnace interest at $2 at oven, and a sale of 10,000 tons has been made to a furnace in the Wheeling district for January shipment at the same price. We also note that a large Eastern consumer has closed for 15,000 tons per month for first half at $1.85. As a number of blast furnaces will go out soon after January 1, the consumption of coke in the two valleys will fall off a good deal. We quote strictly high grade furnace coke for first half delivery at $2 per net ton at oven, but some makes are being offered at $1.85 to $1.90. Foundry coke is in fair demand and is held at $2.50 to $2.75 per net ton at oven. The Connellsville, Courier gives the output of coke in the Upper and Lower Connellsville regions last week as 284,964 net tons, a decrease over the previous week of nearly 23,000 tons.

Philadelphia

PHILADELPHIA, PA., December 29, 1913.

Notwithstanding price uncertainties, which still exist in some lines, a more cheerful feeling is in evidence in both crude and finished products. Consumers attracted by low prices are sounding the market more freely and in instances definite inquiries have been heavier.

Ferroalloys.—Domestic 80 per cent. ferromanganese has been offered delivered in this district at $46.50, seaboard basis, in carload lots, for early shipment. Foreign 80 per cent. is held at $47, seaboard. Fifty per cent. ferrosilicon has been reduced $2 per ton, prices now ranging from $71 to $73, delivered here.

Pig Iron.—The movement, considering the season, has been comparatively good. Consumers are showing increasing interest and have been sounding the market for early 1914 requirements. Prices are not stable, quotations depending on the nature of the order as well as the character of competition. The atmosphere surrounding recent heavy basic sales has not yet fully cleared. The central Pennsylvania transaction reported last week, covering 12,000 tons for first quarter, conditions in connection with which were unusual, was done at practically $14, while it is understood that the later and much larger sale to an Eastern melter was made at $14.25. No further basic business has developed. Sales aggregating 4000 tons of Lebanon Valley low phosphorus iron were made for first quarter shipment at $18 at furnace. There has been little movement in standard analysis low phosphorus iron, which is held at about $21.50 here. A sale of 1000 tons of off grade low phosphorus is reported. Foreign low phosphorus, quotable at $20.50 to $21 here, has advanced a shilling abroad. The movement in the higher foundry grades, while broader, has been confined to moderate lots, seldom exceeding 100 tons. Instances where $15.25 is obtained for standard brands of No. 2X eastern Pennsylvania are fewer, the more general quotation being $15, delivered in this district. Buffalo No. 2X for early delivery has been sold at about that figure. At strongly competitive points concessions are obtainable and prices as low as $14.75 are heard of in neighboring districts, but have not yet been made to apply on business in this vicinity. A moderate volume of business in Virginia foundry has been done at $12.75 at furnace for No. 2X and some producers now accept $12.50 for No. 2 plain. A Delaware River pipe maker is negotiating for a round lot of iron previously reported. Rolling mill grades have been inactive. In some instances deliveries are being taken a trifle more freely. The trade generally looks forward to more ac-

tive buying in foundry grades. Prices for standard brands, delivered in buyers' yards in this district, covering prompt or first quarter shipment range about as follows:

Eastern Pennsylvania No. 2 X foundry	$15.00
Eastern Pennsylvania No. 2 plain	14.75
Virginia No. 2 X foundry	$15.55 to 16.00
Virginia No. 2 plain	15.30 to 15.50
Gray forge	14.25 to 14.50
Basic	14.00 to 14.25
Standard low phosphorus	21.00 to 21.50

Billets.—Some inquiry for both rolling and forging steel has been received, but buyers generally are waiting, in the expectation of lower prices. Makers contend that, with mills idle, the necessity for making concessions for immediate specifications does not exist. Inquiries range from 500 to 1000-ton lots for first quarter and half, but mills resist forward contracts at current prices, which are claimed to be close to cost. Quotations are based on conditions surrounding each individual inquiry. Basic open-hearth rolling billets, for first quarter shipment, range from $21.50 to $22.40 delivered, with ordinary forging steel commanding an advance of about $4 a ton.

Plates.—The range of new orders varies from 50 to 75 per cent. of mill capacity, covering moderate miscellaneous lots as well as some contracts. Mills still restrict forward business to the first quarter. For prompt specification, low prices have been named, but some mills are obtaining 1.40c. for first quarter contracts. Plate makers feel sharply the lack of railroad buying. An inquiry is out for 3000 tons of ship plates from a Delaware River ship builder. While resumptions of operations are irregular, particularly in steel making departments, finishing mills have resumed, although not at capacity, and in a number of cases do not expect to observe the New Year holiday. Prices show a wide range, based on mill conditions. General quotations are from 1.35c. to 1.40c. here, although in special instances prices have been shaded $1 to $2 a ton.

Structural Material.—General orders have been lighter. Business has been closely confined to odd lots for early shipment, and competition for what little comes out is keen. Tonnage demand either in plain or fabricated material has been unimportant. Prices are unchanged at 1.35c. to 1.40c. for plain material, delivered in this district.

Sheets.—Consumers are hammering prices and some low quotations have been reported. Eastern mills are understood to be holding recent quotations more firmly than Western producers. The principal mills in this district are still idle but hope to resume next week. New business has been comparatively light, small lots being taken on the basis of 1.60c. here for No. 10 blue annealed sheets, although concessions for tonnage are believed available.

Bars.—New business has been comparatively light. Some of the iron bar mills have resumed partial operations, following the holiday suspension, but a number are still idle. Competition is sharp and mills having favorable delivery points have made lower prices. Ordinary iron bars are quoted at 1.22½ to 1.27½c. delivered here by the principal mills, although 1.20c. has been done. Steel bars are quiet. Prices range from 1.35c. to 1.40c., delivered here. Low prices of foreign bars have not been met, owing to the unsatisfactory specifications usually governing imported bars.

Coke.—Further sales of contract furnace coke for first half of 1914 are reported at $1.90 to $2 at oven. Offerings of prompt coke have been lighter. A small irregular demand for foundry coke is noted. Prices are unchanged, the following range, per net ton, being named for delivery in buyers' yards in this district:

Connellsville furnace coke	$3.90 to $4.40
Connellsville foundry coke	4.90 to 5.25
Mountain furnace coke	3.60 to 4.10
Mountain foundry coke	4.60 to 4.95

Old Material.—Holiday dullness characterizes the market in most grades. One Eastern steel maker has picked up, in odd lots, about 1000 tons of heavy melting steel scrap at $10, delivered, but most dealers refuse to sell at that price. General sentiment is better and it is believed that an active movement in rolling mill grades will shortly develop. While quotations are largely nominal, the following range about represents figures at which business could be done, delivered in buyers' yards in this district, covering eastern Pennsylvania and taking freight rates varying from 35c. to $1.35 per gross ton:

No. 1 heavy melting steel	$10.00 to $10.25
Old steel rails, rerolling (nominal)	12.25 to 12.50
Low phosphorus heavy melting steel scrap (nominal)	14.00 to 14.50
Old steel axles (nominal)	15.50 to 16.00
Old iron axles (nominal)	21.00
Old iron rails (nominal)	15.50
Old carwheels	12.00 to 12.50
No. 1 railroad wrought	12.75 to 13.00
Wrought-iron pipe	9.00 to 9.25
No. 1 forge fire	7.75 to 8.25
No. 2 light iron (nominal)	5.00
No. 2 busheling (nominal)	7.50 to 8.00
Wrought turnings	6.75 to 7.00
Cast borings	7.50 to 7.75
Machinery cast	12.00 to 12.50
Grate bars, railroad	9.00 to 9.50
Stove plate	9.50 to 10.00
Railroad malleable (nominal)	9.50 to 10.00

Cleveland

CLEVELAND, OHIO, December 29, 1913.

Iron Ore.—Lake traffic in 1913 broke former records. The movement through the canals at Sault Ste. Marie aggregated 79,718,344 net tons, a gain of 7,245,668 tons over 1912. Less than 25 per cent. of this increase is in the heavier movement of ore during the year as compared with 1912. Shipments of soft coal to Lake Superior ports amounted to 15,878,364 tons, an increase of over 3,000,000 tons as compared with 1912. The movement of hard coal was 2,744,574 tons, a gain of over 600,000 tons. The shipments of grain showed a very large increase. Little ore is moving as yet from the docks to the furnace yards. We quote 1913 prices as follows: Old range Bessemer, $4.40; Mesaba Bessemer, $4.15; old range non-Bessemer, $3.50; Mesaba non-Bessemer, $3.40.

Pig Iron.—Some small sales for first half delivery are reported for outside shipment, but no local consumers are in the market. Cleveland prices are unchanged at $13 to $13.50 at furnace for No. 2 for outside shipment, but it is probable that a buyer can get a quotation of $12.75. In the Valley $12.75 for No. 2 has been quoted quite freely, but most producers are asking $13 to $13.25. Corrigan, McKinney & Co. announce that as soon as their supply of coke is used, on about January 1, they will blow out their two Cleveland, two Josephine and Scottdale stacks and will not start up their Genesee furnace, which was to have been blown in this week, giving as the reason for this decision their refusal to pay the present prices asked for coke. If this announced intention is carried out, some of the low prices that have recently been made on pig iron will probably disappear. Sellers are looking for some market activity after the holiday season is over. We quote delivered Cleveland as follows:

Bessemer	$15.90
Basic	13.50
Northern No. 2 foundry	$13.50 to 13.75
Southern No. 2 foundry	15.10 to 15.35
Jackson County silvery, 8 per cent. silicon	18.55

Coke.—Several furnace owners are negotiating for their requirements for the first half. Some will not make contracts at present prices but will buy spot coke. One interest that is in the market for coke for the entire year threatens to blow out all its furnaces rather than to pay the price now asked. While most of the operators are holding to $2 per net ton at oven for furnace coke for the first half, standard coke is being offered at $1.90 and some can be had at $1.80. Foundry coke is inactive, with prices unchanged at $2.50 to $2.75.

Finished Iron and Steel.—The demand is somewhat better, both for spot shipment and contracts. While many buyers are ready to place contracts, mills are not anxious to load up their books with low-priced tonnage. Steel bars are generally quoted at 1.20c., Pittsburgh. A buyer who was reported a week ago to be trying to place an order for 1000 tons for spot shipment at 1.10c., Pittsburgh, has raised his offer to

1.17½c. Steel bars are quoted by one mill at 1.20c. for first quarter and 1.25c. for first half, and by others at 1.25c. to 1.30c. for future delivery. Some contracts have been closed at 1.25c., the buyers being permitted to specify at the going prices as long as these prices are below the contract price. Some plates are being sold at 1.15c., Pittsburgh, for prompt shipment but most of the mills are refusing to shade 1.20c. Structural material is quoted at 1.20c. to 1.25c., Pittsburgh, the later price being for small lots for prompt shipment and for first quarter contracts. The Mt. Vernon Bridge Company has taken 1200 tons for a new plant for the Charles Boldt Glass Company, Huntington, W. Va. Bids were taken December 29 for 4000 tons for the Whitney Building in Detroit and for 1000 tons for the Detroit Athletic Club. Iron bars are weak and quiet. The usual quotation is 1.20c., Cleveland. A sale of 100 tons of forging billets is reported at $22, Pittsburgh. Sheet prices appear to be well maintained at 1.85c. for No. 28 black and 2.85c. for No. 28 galvanized, these prices being at maker's mill. Some small first quarter contracts for black sheets have been placed at 1.90c. An inquiry is pending for 500 tons of reinforcing steel for work in Albany, N. Y. Rivets are quiet, there being little inquiry as yet for contracts. We quote structural rivets at 1.60c. and boiler rivets at 1.70c., Pittsburgh. Warehouse prices are 1.80c. for steel bars and 1.90c. for plates and structural material.

Old Material.—Sentiment in the scrap trade for the first time in many weeks shows an improvement. While prices have not generally advanced, they are a trifle firmer and buyers who refused to consider current quotations a few weeks ago are now more inclined to regard the same quotations as a fair market price. That business is a little more active is probably partly due to the fact that some dealers have been covering to fill contracts that expire at the end of the year. However, a better demand is looked for in January. Dealers are asking an advance of 25c. per ton for heavy melting steel. We quote f.o.b. Cleveland, as follows:

Per Gross Ton

Old steel rails, rerolling	$12.00 to $12.50
Old iron rails	12.50 to 13.00
Steel car axles	16.50 to 17.00
Heavy melting steel	9.50 to 9.75
Old carwheels	11.50 to 12.00
Relaying rails, 50 lb. and over	23.00 to 25.00
Agricultural malleable	9.00 to 9.50
Railroad malleable	10.00 to 10.50
Light bundled sheet scrap	6.50 to 7.00
Bundled tin scrap	11.00 to 11.50

Per Net Ton

Iron car axles	$18.00 to $19.00
Cast borings	5.50 to 5.75
Iron and steel turnings and drillings	4.25 to 4.50
Steel axle turnings	5.75 to 6.00
No. 1 busheling	7.75 to 8.00
No. 1 railroad wrought	9.50 to 10.00
No. 1 cast	10.50 to 11.00
Stove plate	8.00 to 8.50

Cincinnati

CINCINNATI, OHIO, Dec. 30, 1913—(*By Telegraph*).

Pig Iron.—An inquiry for 1000 tons of foundry iron from a Kentucky melter is the largest general one before the trade, although it is reported that a large number of consumers in this territory who need iron for the first half are quietly keeping in close touch with the market. The majority of these will doubtless be willing to consider offers as soon as the holiday season is over. The buying at the moment is to fill urgent requirements and only includes carload tonnages. Sentimentally, the market is in better shape, and producers in both the Hanging Rock district and in the South are more disposed to stiffen quotations. It is still possible to obtain Southern No. 2 foundry at $10.50, Birmingham basis, for first quarter shipment but most of the standard brands are not available below $11. Competition from Lake furnaces is still a factor to be reckoned with in Michigan, central Ohio and northern Indiana, but the Hanging Rock furnaces are uniformly holding out for $13, Ironton, for either prompt or first half shipment. Speculative buying is at a standstill and everyone is holding off until January. It is rumored that two furnaces in southern Ohio will be blown out for repairs within the next two weeks but confirmation on only one of these is obtainable. Very little interest is taken in either basic or malleable. Based on freight rates of $3.25 from Birmingham and $1.20 from Ironton we quote, f.o.b. Cincinnati, as follows:

Southern coke, No. 1 foundry and 1 soft	$14.25 to $14.75
Southern coke, No. 2 foundry and 2 soft	13.75 to 14.25
Southern coke, No. 3 foundry	13.25 to 13.75
Southern, No. 4 foundry	12.75 to 13.25
Southern gray forge	12.25 to 12.75
Ohio silvery, 8 per cent. silicon	17.70 to 18.20
Southern Ohio coke, No. 1	15.20 to 15.70
Southern Ohio coke, No. 2	14.20 to 14.70
Southern Ohio coke, No. 3	13.95 to 14.20
Southern Ohio malleable Bessemer	14.20 to 14.70
Basic, Northern	14.20 to 14.70
Lake Superior charcoal	16.25 to 17.25
Standard Southern carwheel	27.25 to 27.75

(*By Mail*)

Coke.—About 20,000 tons of 48-hr. coke has been contracted for in the Hanging Rock district, and two other sales of unknown tonnage of Pocahontas 48-hr. coke have been made for first half shipment. Furnaces farther East are reported to have made some heavy purchases, and this has somewhat stiffened the Connellsville market. It now appears doubtful if any standard brands of Connellsville furnace coke can be bought much below $2, even for prompt shipment, while that is the general quotation on first half business. Foundry coke is unchanged at $2.50 to $2.75 per net ton at oven, Connellsville, and the usual premium of about 20c. a ton on Wise County and Pocahontas.

Finished Material.—Practically the only subject interesting the mill agencies is the comparatively large number of buildings in this territory that are now contemplated and for which considerable structural material will be required. These specifications will not be issued before spring. The usual holiday dullness with the local dealers is probably a little more marked this year than formerly. It is not possible this early to state positively that the total business for 1913 will be much ahead of the previous year, but there was some increase. The last quarter of the year brought out some very low prices, but business previously booked tended to offset this. The demand for sheets has been uniformly good, except that a few dull periods of short duration occurred in the last half of the year. We quote steel bars, from warehouse stocks, at 1.75c., and structural material at 1.85c. No. 28 black sheets are unchanged at 2.05c. to 2.10c., and galvanized at 3.05c. to 3.10c.

Old Material.—The year 1913 was a very unsatisfactory one for scrap dealers, and the prices prevailing the last week of its wind-up are discouraging. Buying at present is more a case of individual trading between buyer and seller than it has been for several years. The minimum figures given below represent what buyers are willing to pay for delivery in their yards, southern Ohio and Cincinnati, and the maximum quotations are dealers' prices f.o.b. at yards:

Per Gross Ton

Bundled sheet scrap	$6.00 to $6.50
Old iron rails	10.50 to 11.50
Relaying rails, 50 lb. and up	19.25 to 19.75
Rerolling steel rails	10.50 to 11.00
Melting steel rails	8.75 to 9.25
Old carwheels	9.75 to 10.25

Per Net Ton

No. 1 railroad wrought	$8.00 to $8.50
Cast borings	4.00 to 4.50
Steel turnings	4.00 to 4.50
No. 1 cast scrap	8.25 to 8.75
Burnt scrap	5.50 to 6.00
Old iron axles	15.50 to 16.00
Locomotive tires (smooth inside)	9.25 to 9.75
Pipes and flues	5.25 to 5.75
Malleable and steel scrap	6.25 to 6.75
Railroad tank and sheet scrap	4.00 to 4.50

The Galion stockholders of the Cleveland-Galion Motor Truck Company, Galion, Ohio, have approved a proposition to purchase the plant of that company, which is now in the hands of a receiver, and put it in operation.

Buffalo

BUFFALO, N. Y., December 29, 1913.

Pig Iron.—The past week has probably recorded the lowest possible notch in shipments, in consumption and in prices. Little or no new business, amounting to more than carload lots has been reported, the holiday character of the market being much more than ordinarily pronounced. Within the last day or two, however, a slight revival in inquiry is noted, although it has not yet materialized into orders. It is thought by the furnacemen of this district that the passage of the banking and currency bill will have a bracing effect on the market. There is already a decided improvement in sentiment, while an improvement in collections is discernible. It is not anticipated that prices, which in some cases have touched productive cost, will go lower, but may under even a moderate buying movement, show some recovery. We leave last week's quotations unchanged, as follows, f.o.b. furnace, for first quarter delivery:

No. 1 foundry	$13.00 to $13.50
No. 2 X foundry	13.00 to 13.25
No. 2 plain	12.50 to 12.75
No. 3 foundry	12.25 to 12.50
Gray forge	12.00 to 12.25
Malleable	13.00 to 13.50
Basic	13.25 to 13.75
Charcoal	15.50 to 16.50
Charcoal, special brands and analysis	17.00 to 19.50

Old Material.—The better feeling reported last week is still in evidence. Heavy melting steel is showing more activity and orders for about 4000 tons were placed for this class of scrap at $9.50 to $10, Buffalo. Borings and turnings, which have been moving quite freely even during the dull period, are still in good demand at prevailing prices. Business in other classes of scrap is for small tonnages only, dealers not being inclined to sell more than limited quantities at present prices. The prevailing opinion is that bottom has been reached and that the trend from now on will be toward higher prices. We quote as follows, per gross ton, f.o.b. Buffalo:

Heavy melting steel	$9.75 to $10.50
Bundled sheet scrap	6.00 to 6.50
No. 1 busheling scrap	8.50 to 9.00
No. 2 busheling scrap	6.00 to 6.50
Low phosphorus steel scrap	15.00 to 15.75
Iron rails	15.00 to 15.50
No. 1 railroad wrought	12.00 to 12.50
No. 1 railroad and machinery cast scrap	12.00 to 12.50
Steel axles	17.00 to 17.50
Iron axles	22.50 to 23.00
Carwheels	10.75 to 11.25
Railroad malleable	10.50 to 11.00
Locomotive grate bars	9.50 to 10.00
Wrought pipe	8.50 to 9.00
Machine shop turnings	5.00 to 5.50
Heavy steel axle turnings	8.00 to 8.75
Clean cast borings	5.50 to 6.00
Stove plate (net ton)	9.75 to 10.00

Finished Iron and Steel.—No change is noted as yet from the quiet of holiday conditions, but there is a continued improvement in sentiment as regards prospects for a gradual resumption of normal buying in all lines of finished products. This is expected shortly after the inventory period. In wire products the market shows an improvement in tone. Contractors in fabricated structural lines find the situation quiet, but with favorable indications for increased business in the near future. Plans are reported in preparation for a 10-story Furniture Exchange building to be erected at Jamestown, N. Y., requiring between 600 and 700 tons. The George Kellogg Structural Company, Buffalo, has received contract for steel, about 100 tons, for a building to be erected by the Buffalo Cement Company for the Frank H. Hall Company. The Onondaga Structural Steel Company, Syracuse, has contracts for steel for a case hardening building for the New Process Gear Company, of that city; for a machine shop for the Will & Banemer Company and a theater building at Syracuse, each requiring a small tonnage. Contract for steel for the Art Building to be erected by Vassar College, Poughkeepsie, about 250 tons, has been let to the Phoenix Iron Works, New York City. A considerable number of other building projects are due to come out in a short time in this territory.

British Market Tone More Cheerful

(*By Cable*)

LONDON, ENGLAND, December 30, 1913.

Holiday conditions are dominant, but the tone is fairly cheerful, and indications are more favorable. Stocks in consumers' hands are very small and a buying movement is probable before long. A steadier demand for tin plates is reported by makers. Stocks of pig iron in Connal's stores are 138,360 gross tons, against 141,374 tons last week. We quote as follows:

Tin plates, coke 14 x 20, 112 sheets, 108 lb., f.o.b. Wales, 12s. 7½d. ($3.07).

(The following prices are per ton of 2240 lb.):

Cleveland pig-iron warrants (Monday), 50s. 2d. ($12.20), against 50s. ($12.16), one week ago.

No. 3 Cleveland pig iron, makers' price, f.o.b. Middlesbrough, 50s. 9d. ($12.35), against 50s. 6d. ($12.29) one week ago.

Hematite pig iron, f.o.b. Tees, 60s. 6d. ($14.72).

Ferromanganese, £9 4s. 9d. ($44.95).

Steel sheet bars (Welsh), delivered at works in Swansea Valley, £4 15s. ($23.11).

Steel bars, export, f.o.b. Clyde, £6 ($29.20).

Steel joists, 15-in., export f.o.b. Hull or Grimsby, £5 12s. 6d. ($27.37).

Steel ship plates, Scotch, delivered local yards, £6 17s. 6d. ($33.46).

Steel black sheets, No. 28, export, f.o.b. Liverpool, £9 ($43.80).

Steel rails, export, f.o.b. works port, £6 5s. ($30.41).

(The following prices are per export ton of 1015 kilos, equivalent to 2237.669 lb.):

German sheet bars, f.o.b. Antwerp, 82s. 6d. ($20.07).

German 2-in. billets, f.o.b. Antwerp, 80s. ($19.46).

German basic steel bars, f.o.b. Antwerp, £4 11s. to £4 12s. ($22.13 to $22.37).

German joists, f.o.b. Antwerp, £5 5s. to £5 8s. ($25.55 to $26.28).

Birmingham

BIRMINGHAM, ALA., December 27, 1913.

Cast-Iron Pipe.—Manufacturers are a unit in expecting an improvement early in 1914. Many scheduled municipal improvements have been held off, which are now expected to eventuate in good orders. All plants are keeping their forces intact. Prices have not changed and are as follows, per net ton: 4-in. $22; 6-in. and upward, $20.

Pig Iron.—It is the consensus of opinion among furnacemen that pig iron is stronger than it has been for some time, so far as the Birmingham district is concerned. One interest with only two active furnaces has sold 15,000 tons since the middle of the month for delivery, mostly in Southern territory, during the first and second quarters. Nothing under the $11 basis is admitted. One other company is reported as well sold into the first quarter, and there is but one company with an appreciable amount of foundry iron on hand. There seems to have been some iron sold under $11 by one interest for spot shipment, but it is denied that this quotation will be made in general business for the year. Stocks of free iron are under 100,000 tons. Brokers agree with the furnacemen that the tone is stronger, and join in the prediction of the maintenance of the $11 basis. Even during the holidays some sales were made and inquiries are reported as much more brisk. There is decidedly more optimism since the passage of the banking and currency bill, and iron men express themselves as satisfied that free trade in pig iron will not affect this district. The furnaces as a rule are working well. The Sloss-Sheffield Steel & Iron Company, with its four stacks in blast, is making as much pig iron as it ever did before with six, a recent daily output having been in excess of 1000 tons, or 250 tons per stack. One of the city furnaces is being repaired and another is ready for the torch if needed. Charcoal and Clifton iron are in demand to the extent of the output. Movements are the equivalent of the make. Consumers are not hurrying shipments, but they are also not issuing

stop orders. Altogether the furnace interests enter the new year with a decidedly better feeling than for some time. We quote, per gross ton, f.o.b. Birmingham district furnaces, as follows:

No. 1 foundry and soft	$11.25 to $11.50
No. 2 foundry and soft	10.75 to 11.00
No. 3 foundry	10.25 to 10.75
No. 4 foundry	10.00 to 10.50
Gray forge	9.75 to 10.25
Basic	10.75 to 11.00
Charcoal	23.50 to 24.00

Coal and Coke.—Some of the larger mines have loaded up well with contracts for the coming year. The Alabama Company secured the very desirable contract with the Birmingham Railway, Light & Power Company for 150,000 tons. Domestic mines are reported busier. A good deal of coke has moved westward recently. There is a demand for the output, with prices firm. We quote coke, per net ton, f.o.b. oven, as follows: Furnace, $2.50 to $3; foundry, $3.25 to $4, according to quality.

Old Material.—Dealers report business at a temporary standstill, owing to the reluctance of consumers to take on stock until the year has been well begun. The outlook, however, is said to be good. We quote, per gross ton, f.o.b. dealers' yards, as follows:

Old iron axles (small)	$15.00 to $15.50
Old steel axles (light)	15.00 to 15.50
Old iron rails	12.50 to 13.50
No. 1 railroad wrought	12.00 to 12.50
No. 2 railroad wrought	10.00 to 10.50
No. 1 country wrought	9.50 to 10.00
No. 2 machinery cast	10.50 to 11.00
No. 1 steel scrap	10.50 to 11.00
Tram carwheels	10.50 to 11.00
Standard carwheels	12.00 to 12.50
Light cast and stove plates	9.00 to 9.50

New York

NEW YORK, December 30, 1913.

Pig Iron.—The purchase of 800 tons of foundry iron for delivery at Paterson, N. J., has emphasized the low level to which the market has sunk. On 400 tons of 2.5 to 3 per cent. silicon iron included in this transaction the delivered price was a shade under $14.50. This iron will come from Buffalo. The remaining 400 tons, which is low silicon iron, went to an eastern Pennsylvania furnace at a price under $14.25, delivered. Buffalo furnaces have sold iron for eastern delivery at $12.50 to $13 for No. 2 X foundry at furnace. Eastern Pennsylvania furnaces have been put to it to meet these prices in territory to which the freight from Buffalo is $1.75. Little business is pending in this market. One inquiry that has just come up is for 1000 tons for a New Jersey foundry and another is 500 tons for Lehigh Valley delivery. The falling off in foundry operations has been slightly accentuated, but a good deal of business is involved in castings requirements that will come up for estimate soon after the turn of the year. We quote Northern iron for tidewater delivery as follows: No. 1 foundry, $15 to $15.25; No. 2 X, $14.75 to $15; No. 2 plain, $14.50 to $14.75. Southern iron is quoted at $15.25 to $15.75 for No. 1 and $15 to $15.25 for No. 2.

Finished Iron and Steel.—Buyers have perhaps shown a little more activity in making inquiries and prices have been asked on contracts for large tonnages for one year, six months and three months, though so little business is resulting thus far that it may be that the consumers are merely trying out the seller. More contracting for the first quarter is learned of, going at the general market of 1.20c. for bars, but sometimes 1.25c. for shapes and plates. More is heard of an expectation of betterment in demand by the middle of January. The American Car & Foundry Company is to build 100 subway cars for the Brooklyn Rapid Transit and the Chesapeake & Ohio is inquiring for 1000 gondolas for the Hocking Valley. It is estimated that the total car purchases of the year were about 100,000, as compared with 230,000 in 1912, although the latter figure was above the average. Hence it is expected that car buying in 1914 will have to be on a relatively large scale. The Delaware & Hudson is to build an office structure and freight house at Albany, N. Y., involving 500 tons. The Hinkle Iron Company has taken a contract for 500 tons for an apartment house, Seventy-second street and Lexington avenue, New York. We quote steel bars, mill shipments, at 1.20c., Pittsburgh, or 1.36c., New York, and plates and plain structural material at 1.20c. to 1.25c., Pittsburgh, or 1.36c. to 1.41c., New York; refined iron at 1.30c. to 1.35c., New York. We quote iron and steel bars from store, 1.90c. to 1.95c., and shapes and plates, 1.95c. to 2c.

Ferroalloys.—The effect in this market of the announcement last week that the Carnegie Steel Company had become a seller of 80 per cent. ferromanganese has been to create considerable interest but not to reduce the regular quotations of the foreign producers of $47, Baltimore. Inquiries have been stimulated slightly but it is evident that most consumers are well stocked and are in no hurry to make any contracts in the expectation that the effect of the new domestic competition will be to lower the price. Present market activity is confined to sales of small lots for quick delivery. The large inquiry for 50 per cent. ferrosilicon, reported last week, is still before the market. Quotations, which are $2 less than last week, are $73 for carloads; $72 for 100 tons and $71 for 600 tons and over.

Cast-Iron Pipe.—More business is in sight than for a considerable time. Troy, N. Y., will open bids January 2 on 6122 tons of 30-in.; Worcester, Mass., on the same day on 3780 tons of 36-in.; Chicago, January 3, on 12,000 tons of 8 to 48 in.; Providence, R. I., January 5, on 780 tons of 4, 6 and 12 in. Some private buying is being done for spring delivery. Prices are inclined to stiffen, but carload lots are still quoted at $22 to $23 per net ton, tidewater, for 6 in.

Old Material.—While the sentiment is better, no improvement is seen in either inquiries or sales. More confidence is expressed in the expectation of a buying movement in January. Quotations are nominally unchanged as follows, per gross ton, New York:

Old girder and T rails for melting	$7.50 to $8.00
Heavy melting steel scrap	7.50 to 8.00
Relaying rails	20.50 to 21.00
Rerolling rails	10.00 to 10.50
Iron car axles	18.50 to 19.50
Steel car axles	12.50 to 13.00
No. 1 railroad wrought	10.25 to 10.75
Wrought-iron track scrap	9.00 to 9.50
No. 1 yard wrought, long	8.50 to 9.00
No. 1 yard wrought, short	7.75 to 8.25
Light iron	2.50 to 3.00
Cast borings	4.75 to 5.00
Wrought turnings	4.50 to 4.75
Wrought pipe	6.75 to 7.25
Carwheels	10.50 to 11.00
No. 1 heavy cast, broken up	10.00 to 10.50
Stove plate	7.00 to 7.50
Locomotive grate bars	6.50 to 7.00
Malleable cast	7.00 to 7.50

Metal Market

NEW YORK, December 30, 1913.

The Week's Prices

Cents Per Pound for Early Delivery

	Copper, New York			Lead		Spelter	
Dec.	Lake	Electrolytic	Tin, New York	New York	St. Louis	New York	St. Louis
26	14.75	14.50	37.00	4.10	4.05	5.20	5.05
27	15.00	14.75	37.00	4.10	4.05	5.20	5.05
29	15.12½	14.87½	37.70	4.15	4.10	5.35	5.05
30	15.12½	14.87½	37.37½	4.15	4.10	5.35	5.20

The metal market has quite suddenly shown much greatr activity, accompanied by higher prices. Copper is up about one-half cent per lb. Tin is up three-fourths cent. Lead is up five points in New York and expected to go higher. Spelter has advanced nearly a quarter of a cent. Antimony has not participated in the improvement.

New York

Copper.—In the latter part of last week good buying set in and lasted until yesterday. The sales ran into millions of pounds, about 75 per cent. of which was for export. The demand caused electrolytic to advance to 14.87½c. cash, at which it is quoted to-day and Lake to advance to the nominal quotation of 15.12½c. The movement was caused by the better sentiment which prevailed not alone in copper but in nearly all the metals. Spot was quoted in London to-day at £66 and futures at £66, 10s.

Pig Tin.—The market has been much more active, with good buying for futures on both Friday and Saturday of last week and to some extent yesterday, when

it slackened off. London advanced sharply under the increased demand; the price went up here and buyers declined to follow. The business of Friday and Saturday was done at stiff premiums in anticipation of the advance which came on Monday. In the flurry of activity there was a shortage of sellers and a superabundance of buyers, as both expected prices to advance. Tin was quoted in New York to-day at 37.37½c. The London quotation for spot to-day is £170 12s 6d., and for futures £172.

Lead.—With the tone of the market improved, the American Smelting & Refining Company yesterday made an advance of 5 points in New York and the disparity between the New York and St. Louis prices indicates a still further advance. The price is now 5.15c. New York. At the very low figures which were quoted last week the big interest was forced to take all of the business and this led to the advances. Many good inquiries have come to light and the feeling is better all around. It is believed that 4.25c., New York, will be reached shortly. The St. Louis price to-day is 4.10c.

Spelter.—Under the impetus of a much better inquiry, some buying and a stronger tone generally, spelter yesterday advanced to 5.35c., New York and 5.20c., St. Louis. While the situation is much better, buyers have not taken hold to the extent hoped for.

Antimony.—Quotations are practically unchanged though they are a trifle weaker, there being a tendency to give concessions in the effort to start buying. Hallett's is quoted at 7c. to 7.12½c., Cookson's at 7.40c. to 7.50c. and Chinese and Hungarian grades at 6c. to 6.50c.

St. Louis

DECEMBER 29.—The metal markets have shown some improvement, particularly Missouri products, which were affected by the leading smelting company's advance of $2 per ton. Quotations here are: Lead, 4.05c. to 4.10c.; spelter, 5.10c. to 5.15c.; tin, 37.22½c. to 37.60c.; Lake copper, 15.35c. to 15.85c.; electrolytic copper, 14.85c. to 15.10c.; Cookson's antimony, 7.80c. to 7.95c. In the Joplin ore market there was a better feeling in both zinc and lead. The basis range for 60 per cent. zinc blende was $38 to $41 per ton, with top settlements at about $44. Calamine was slightly better, with the basis range for 40 per cent. at $19 to $21, with the best settlements at about $24. Lead ore was firmer at $49 to $50 for 80 per cent. We quote miscellaneous scrap metals as follows: Light brass, 4.50c.; heavy yellow brass, 7c.; heavy red brass and light copper, 9c.; heavy copper and copper wire, 10.50c.; zinc, 2.75c.; lead, 3c.; pewter, 22c.; tinfoil, 28c.; tea lead, 2.75c.

Chicago

CHICAGO, ILL., December 29, 1913.

Pig Iron.—The following quotations are for iron delivered at consumers' yards, except those for Northern foundry, malleable Bessemer and basic iron, which are f.o.b. furnace and do not include a local switching charge averaging 50c. a ton:

Lake Superior charcoal, Nos. 1, 2, 3, 4	$15.25 to $15.75
Northern coke foundry, No. 1	15.00 to 15.50
Northern coke foundry, No. 2	14.00 to 15.00
Northern coke foundry, No. 3	13.50 to 14.00
Southern coke, No. 1 foundry and No. 1 soft	15.35 to 15.85
Southern coke, No. 2 foundry and No. 2 soft	14.85 to 15.35
Southern coke, No. 3	14.35 to 14.85
Southern coke, No. 4	13.85 to 14.35
Southern gray forge	13.85 to 14.35
Southern mottled	13.35 to 13.85
Malleable Bessemer	14.50 to 15.00
Standard Bessemer	17.65
Basic	13.50 to 14.00
Jackson Co. and Kentucky silvery, 6 per cent.	18.40
Jackson Co. and Kentucky silvery, 8 per cent.	19.40
Jackson Co. and Kentucky silvery, 10 per cent.	20.40

Rails and Track Supplies.—The past week has brought no apparent setback in the negotiations of several railroads covering contracts for rails and track supplies, and announcement of the placing of these orders is expected early in January. The rail mills at Chicago are down during the holiday week. We quote standard railroad spikes at 1.60c. to 1.70c., base; track bolts with square nuts, 2.05c. to 2.10c., base, all in carload lots, Chicago; tie plates, $27 to $28 net ton; standard section Bessemer rails, Chicago, 1.25c., base; open hearth, 1.34c.; light rails, 25 to 45 lb., 1.25c.; 16 to 20 lb., 1.30c.; 12 lb., 1.35c.; 8 lb., 1.40c.; angle bars, 1.50c., Chicago.

Plates.—In the contracts for plates that are being tentatively considered there is a tendency to restore plate quotations to the same basis as structural shapes. Concessions of 50c. to $1 a ton from the basis of 1.20c., Pittsburgh, have been more common for plates than shapes. For Chicago delivery from mill, we quote 1.33c. to 1.38c.

For Chicago delivery from store, we quote 1.75c.

Sheets.—Some of the sheet mills at Indiana Harbor are continuing to operate, while most of the other mills are idle, reflecting the fairly satisfactory volume of sheet tonnage for a number of weeks past. First quarter bookings of sheets in this territory are well up to mill capacity but the mills are offering decided opposition to contracts which go farther into the year. We quote for Chicago delivery from mill: No. 10 blue annealed, 1.68c. to 1.73c.; No. 28 black, 2.03c. to 2.08c.; No. 28 galvanized, 3.03c. to 3.08c.

For sheets out of store we quote for Chicago delivery as follows, minimum prices applying on bundles of 25 or more: No. 10 blue annealed, 1.95c.; No. 28 black, 2.45c. to 2.55c.; No. 28 galvanized, 3.50c. to 3.60c.

Bars.—There appears to be less variance from the Pittsburgh basis of 1.15c. for steel bars in this market than at any time in the past few weeks. In the light of the increased inquiry, this condition promises to become even more firmly established. The Inland mill, which is the only active bar-iron operation of the Republic Iron & Steel Company, is running steadily at capacity, but a 50 per cent. rate of operation more accurately represents the general situation. We quote for mill shipment as follows: Bar iron, 1.10c. to 1.15c.; soft steel bars, 1.28c. to 1.33c.; hard steel bars, 1.35c. to 1.40c.; shafting in carloads, 65 per cent. off; less than carloads, 60 per cent. off.

We quote store prices for Chicago delivery: Soft steel bars, 1.65c.; bar iron, 1.65c.; reinforcing bars, 1.65c. base, with 5c. extra for twisting in sizes ½ in. and over, and usual card extras for smaller sizes; shafting 57 per cent. off.

Rivets and Bolts.—Quotations for rivets and bolts continue nominal. We quote from mill as follows: Carriage bolts up to ⅜ x 6 in., rolled thread, 80-7½; cut thread, 80; larger sizes, 75; machine bolts up to ⅜ x 4 in., rolled thread, 80-12½; cut thread, 80-7½; large size, 75-7½; coach screws, 80-15-10; hot pressed nuts, square head, $6 off per cwt.; hexagon, $6.70 off per cwt. Structural rivets, ½ to 1¼ in., 1.88c., base, Chicago, in carload lots; boiler rivets, 10c. per 100 lb. additional.

Out of store we quote for structural rivets, 2.40c., and for boiler rivets, 2.60c. Machine bolts up to ⅜ x 4 in., 70-10-10; larger sizes, 70-12½; carriage bolts up to ⅝ x 6 in., 75-10; larger sizes, 70-12½ off. Hot pressed nuts, square head, $5.50, and hexagon, $6.20 off per cwt.

Wire Products.—For immediate shipment, concessions of $1 a ton are being quoted for wire products, now nominally on the basis of $1.55, Pittsburgh. For contracts the mills decline to shade the full market price, and in fact are showing no great desire to invite contracts at all. We quote to jobbers as follows: Plain wire, No. 9 and coarser, base, $1.53; wire nails, $1.68 to $1.73; painted barb wire, $1.68 to $1.73; galvanized, $2.05 to $2.10; polished staples, $1.68 to $1.73; galvanized, $2.05 to $2.10, all Chicago.

Cast-Iron Pipe.—The city of Chicago is in the market for 12,000 tons and St. Paul will buy 4000 tons. At Indianapolis a contract was awarded last week for 5000 tons. We quote as follows, per net ton, Chicago: Water pipe, 4 in., $27; 6 to 12 in., $25; 16 in. and up, $24, with $1 extra for gas pipe.

Old Material.—Prices for scrap made on a number of purchases in lots up to 1000 tons indicate that the general market has not changed from the level last quoted. With perhaps one exception, the policy of buying scrap against an anticipated advance has not

become conspicuous. Railroad offerings for the week include 3000 tons by the St. Louis & San Francisco, 1000 tons by the Chicago Great Western and 4300 tons by the Chicago, Rock Island & Pacific. We quote for delivery at buyers' works, Chicago and vicinity, all freight and transfer charges paid, as follows:

Per Gross Ton

Old iron rails	$13.00 to $13.50
Old steel rails, rerolling	11.25 to 11.75
Old steel rails, less than 3 ft.	10.25 to 10.75
Relaying rails, standard section, subject to inspection	24.00
Old carwheels	11.50 to 12.00
Heavy melting steel scrap	9.00 to 9.50
Frogs, switches and guards, cut apart	9.00 to 9.50
Shoveling steel	8.00 to 8.50
Steel axle turnings	6.50 to 7.00

Per Net Ton

Iron angles and splice bars	$11.75 to $12.25
Iron arch bars and transoms	11.75 to 12.25
Steel angle bars	8.00 to 8.50
Iron car axles	17.00 to 17.50
Steel car axles	12.00 to 12.50
No. 1 railroad wrought	8.50 to 8.75
No. 2 railroad wrought	7.75 to 8.00
Cut forge	7.75 to 8.00
Steel knuckles and couplers	8.75 to 9.25
Steel springs	9.25 to 9.75
Locomotive tires, smooth	10.25 to 10.75
Machine shop turnings	4.00 to 4.25
Cast borings	3.75 to 4.00
No. 1 busheling	7.25 to 7.50
No. 2 busheling	5.75 to 6.00
No. 1 boilers, cut to sheets and rings	5.75 to 6.00
Boiler punchings	9.50 to 10.00
No. 1 cast scrap	10.00 to 10.25
Stove plate and light cast scrap	9.25 to 9.75
Grate bars	8.25 to 8.75
Railroad malleable	9.00 to 9.25
Agricultural malleable	8.00 to 8.50
Pipes and flues	6.50 to 7.00

St. Louis

ST. LOUIS, MO., December 29, 1913.

A generally better tone prevails in this market. Tentative inquiries are increasing, but specific tonnages are now being asked for only a little more frequently.

Pig Iron.—Inquiries made during the week show that a considerable number of consumers are about ready to consider purchasing if convinced that the bottom has really been reached. Sales reported include 1000 tons of malleable and 300 tons of No. 2 Southern, both for first half delivery, 600 tons of high manganese No. 2 and 1000 tons each of No. 2 and No. 3 Southern to a stove foundry. Among the inquiries is one for about 1700 tons of No. 2 Southern.

Coke.—Transactions the past week were in very small lots, on which prices were above the market for large quantities. Quotations here run up to $2.65 at oven for best 72-hr. selected Connellsville foundry coke, with furnace coke quoted at $1.85, both for future delivery. By-product coke continues to be quoted on the Connellsville basis.

Finished Iron and Steel.—A fair tonnage of structural material was taken in small lots, fabricators being still at work. A considerable number of inquiries without specific tonnage mentioned are reported coming in, evidencing a tendency toward improvement of business. In standard section steel rails a few small lots were sold for replacement and repair work, but the railroads have made no move toward contracts for the coming year. Lumber and coal companies bought sparingly of light rails. Track fastenings are quiet. In bars business has not been active. Plates are quiet and there are no car orders being placed or inquiries in the market to increase interest in this line. The Alton Steel Company, Alton, Ill., whose plant is now in operation, has sold 500 tons of steel billets to a Kansas City consumer.

Old Material.—The principal feature of the scrap market has been the inquiry for delivery through the first quarter. This and other minor happenings have developed a more hopeful feeling in the market. There has been no development of outside business of consequence and no shipping is being done, but steel especially has improved and quotations generally are marked up. The only railroad list out during the week was that of the Frisco, with 350 tons. January is expected to bring out considerable quantities. We quote dealers' buying prices, f.o.b. St. Louis, as follows:

Per Gross Ton

Old iron rails	$11.25 to $11.50
Old steel rails, rerolling	11.00 to 11.50
Old steel rails, less than 3 feet	9.75 to 10.00
Relaying rails, standard section, subject to inspection	23.00 to 24.00
Old carwheels	10.75 to 11.00
No. 1 railroad heavy melting steel scrap	9.75 to 10.00
Shoveling steel	8.25 to 8.75
Frogs, switches and guards cut apart	9.50 to 10.00

Per Net Ton

Iron angle bars	$10.25 to $10.50
Steel angle bars	8.50 to 9.00
Iron car axles	15.75 to 16.25
Steel car axles	11.25 to 11.50
Wrought arch bars and transoms	11.00 to 11.50
No. 1 railroad wrought	8.50 to 9.00
No. 2 railroad wrought	8.00 to 8.50
Railroad springs	8.50 to 9.00
Steel couplers and knuckles	8.50 to 9.00
Locomotive tires, 42 in. and over, smooth	9.50 to 10.00
No. 1 dealers' forge	7.50 to 8.00
Mixed borings	3.25 to 3.50
No. 1 busheling	7.50 to 8.00
No. 1 boilers, cut to sheets and rings	5.50 to 6.00
No. 1 cast scrap	9.50 to 10.00
Stove plate and light cast scrap	7.50 to 8.00
Railroad malleable	8.00 to 8.25
Agricultural malleable	7.25 to 7.50
Pipes and flues	5.25 to 5.50
Railroad sheet and tank scrap	4.50 to 5.00
Railroad grate bars	6.50 to 6.75
Machine shop turnings	4.00 to 4.25
Bundled sheet scrap	5.50 to 6.00

San Francisco

SAN FRANCISCO, CAL., December 23, 1913.

Holiday influence is felt to an increasing extent, as the consuming demand has been somewhat interrupted, and all large buyers are disposed to hold off entirely until stock-taking is completed. The local jobbing market is still in bad shape, and merchants complain that business in many lines is being done at a loss, with little prospect of improvement until old stocks are completely wiped out. Somewhat more optimistic sentiment is expressed, however, in regard to the future.

Bars.—Arrivals of foreign material are increasing, and a heavy tonnage is expected in the next few months, causing a further curtailment in the demand for domestic bars. There is little prospect of additional business being placed with importers in the immediate future, however, as foreign and domestic prices are more nearly on a parity than before. About the lowest figure now quoted on foreign bars is 1.55c., while domestic interests have reduced their price to 1.65c. for sea shipment. At these figures many buyers prefer American steel. There is only a scattering demand for reinforcing material, large orders being lacking, but with comparatively little foreign competition local mills have maintained a price of 2c. on open-hearth bars for all ordinary business. The Pacific Coast Steel Company is now running double shift, a month's shutdown for repairs having brought a large accumulation of unfilled orders.

Structural Material.—The last fortnight has brought nothing of special interest in the way of fabricating contracts, and few important jobs are being figured at the moment. The outlook is considered fair in view of the number of buildings planned, but depends entirely on the availability of money. Buying of plain material is limited to nearby requirements.

Plates.—While contracts have been placed by a few large consumers, most buyers are still holding off. In view of the contemplated increase in oil storage facilities, there is considerable business in sight, and part of it should come out early in the year.

Sheets.—While current business is greatly restricted at the moment, manufacturers are making a fairly liberal estimate of next year's requirements, and many of them have placed contracts covering the first quarter on the basis of present prices.

Cast-Iron Pipe.—The city of Portland, Ore., takes bids December 24 for 1200 tons, and will be out in January or February for about 10,000 tons. The Los Angeles contract was placed last week, and Pasadena is taking bids on a small lot. In general municipal orders are scarce, and the gas companies are buying

only on a hand-to-mouth scale. The passage of the Hetch Hetchy bill is not considered as of immediate importance, but the prospective acquisition of the Spring Valley distributing system by the city will call for a heavy tonnage, as extensions are badly needed.

Pig Iron.—Local foundry conditions have not been normal since 1907, but are said to be now the worst in many years, the consumption of pig iron being greatly curtailed. The situation is not improved by the burdensome accumulation now held by importers. Many foundries still have enough iron from old purchases to cover current needs, and others are buying only in small lots, and looking for bargains. Agents for Southern iron continue to quote No. 1 foundry at about $22.50, but it is not moving. Similar grades of foreign iron can hardly be quoted, as there is a wide divergence among different sellers. Some lots are held pretty closely up to the domestic figures, but liberal concessions could probably be had.

Coke.—The foundry trade is more than amply supplied. Prices, however, are held about up to the last quotations, $13 to $14 per net ton, ex yard, and $11 to $11.50 to arrive.

Old Material.—While the movement of cast-iron scrap has been somewhat curtailed, desirable offerings are scarce and prices well maintained. Rerolling rails are moving about as usual at the figures last quoted. There is still some uncertainty about the outlook for steel melting scrap. The principal consumers have a fair supply on hand, and claim to have plenty in sight that can be had at $9 or less, while dealers continue to ask $12 per gross ton. The scrap situation here is complicated by the uncertainty of local supplies and high freight rates from outside points. Cast-iron scrap is quoted as before at about $18 per net ton; wrought scrap, $13 to $15 per net ton, and rerolling rails, $15 per net ton.

Boston

BOSTON, MASS., December 30, 1913.

Old Material.—Dealers have absorbed a good deal of confidence in the last week. They state that conditions look better, although not yet evidenced in orders nor even in inquiries, but they believe that soon the trend of business will be upward. In the meantime prices have not changed. The quotations given below are based on prices offered by the large dealers to the producers and to the small dealers and collectors, per gross ton, carload lots, f.o.b. Boston and other New England points which take Boston rates from eastern Pennsylvania points. In comparison with Philadelphia prices the differential for freight of $2.30 a ton is included. Mill prices are approximately 50c. a ton more than dealers' prices:

Heavy melting steel	$7.75 to $8.00
Low phosphorus steel	13.75 to 14.75
Old steel axles	13.25 to 13.75
Old iron axles	21.25 to 21.75
Mixed shafting	12.25 to 12.50
No. 1 wrought and soft steel	9.00 to 9.25
Skeleton (bundled)	6.00 to 6.50
Wrought iron pipe	6.50 to 7.00
Cotton ties (bundled)	7.00 to 7.25
No. 2 light	3.75 to 4.25
Wrought turnings	4.50 to 5.00
Cast borings	4.50 to 5.00
Machinery, cast	11.25 to 11.50
Malleable	8.00 to 8.25
Stove plate	7.75 to 8.00
Grate bars	6.25 to 6.50
Cast-iron carwheels	11.00 to 11.25

Lulea appears to be entering into serious competition with Narvik in Norway for the export of ore from the Kiiruna mines. Shipments from that port have increased recently and last year amounted to 1,600,000 tons. This quantity does not by any means represent the possible shipments from Lulea, for arrangements have been made to store 2,000,000 tons and 4,000,000 tons per year can be shipped when loading provisions now under construction for handling such a greatly increased quantity are completed.

Iron and Industrial Stocks

NEW YORK, December 30, 1913.

The feeling of cheerfulness on the Stock Exchange has made itself still more manifest since last report and prices have touched higher levels. The range of prices on active iron and industrial stocks from Wednesday of last week to Monday of this week was as follows:

Allis-Chal., com..	8⅛- 9	Pressed St., com.	26½- 27½
Allis-Chal., pref.	42½	Ry. Spring, com.	25 - 25½
Am. Can, com...	29⅛- 31¼	Republic, com...	20 - 20½
Am. Can, pref...	89⅛- 91	Republic, pref...	80¼- 82
Am. Car & Fdry., com.	44¼- 45¼	Rumely Co., com.	15 - 16
Am. Loco., com..	30¼- 31¾	Rumely Co., pref.	34 - 38⅛
Bald. Loco., com.	39½	Sloss, com.	28
Bald. Loco., pref.	101¼-101¾	U. S. Steel, com.	58¼- 60⅝
Beth. Steel, com..	29⅞- 30⅞	U. S. Steel, pref.	106 -106⅞
Beth. Steel, pref.	68 - 68½	Westingh'se Elec.	65 - 66½
Case (J.I.), pref.	90⅞- 91	Am. Ship, pref.	80¼
Colorado Fuel...	28¼- 29⅜	Chic. Pneu. Tool	51 - 51½
Deere & Co., pref.	91½	Cambria Steel...	48 - 49⅞
General Electric..	140 -141	Lake Sup. Corp.	21 - 23¼
Gt. N. Ore Cert..	33⅝- 35¼	Warwick	10¼
Int. Harv., com..	101½-102¼	Cruc. Steel, com.	14 - 14¼
Int. Harv., Corp.	101¾	Cruc. Steel, pref.	87 - 87½
Int. Pump, com..	6 - 6½	La Belle Iron, com.	41 - 41½
Int. Pump, pref.	18	La Belle Iron, pref.	116⅛
Nat. En. & St., com.	10¾- 12		

Dividends Declared

The Youngstown Sheet & Tube Company, regular quarterly, 1¾ per cent. on the preferred and 2 per cent. on the common stock, both payable January 1.

The Pittsburgh Coal Company, regular quarterly, 1¼ per cent. on the preferred stock, payable January 26.

The Westinghouse Electric & Mfg. Company, regular quarterly, 1¾ per cent., on the preferred stock, payable January 15, and 1 per cent. on the common, payable January 30.

The National Fire Proofing Company, regular quarterly, 1 per cent., payable January 10.

The Cambria Steel Company, extra dividend, 1 per cent., payable January 20.

The American Screw Company, regular quarterly, 2½ per cent., payable December 31.

The Nova Scotia Steel & Coal Company, Ltd., regular quarterly, 1½ per cent. on the common and 2 per cent. on the preferred stock, both payable January 15.

The Standard Screw Company, 2 per cent. on the common and 3 per cent. on the preferred stock, both payable January 1.

The Sharon Steel Hoop Company, regular quarterly, 1¾ per cent., payable January 1.

Personal

Henry M. Leland, general manager Cadillac Motor Car Company, Detroit, has been nominated for president of the Society of Automobile Engineers.

S. S. Freeman, general manager Carbon Iron & Steel Company, Parryville, Pa., has been elected president of the Eastern Pig Iron Association for 1914, succeeding Robert E. Brooke, manager E. & G. Brooke Iron Company, Birdsboro, Pa. W. S. Pilling, Pilling & Crane, Philadelphia, has been re-elected secretary.

C. E. Blue, president and general manager of the Wheeling Mold & Foundry Company, Wheeling, W. Va., has resigned, and H. E. Field, heretofore with Mackintosh, Hemphill & Co., of Pittsburgh, has been named as his successor, effective January 1. Mr. Field is a graduate of the Worcester Polytechnic Institute and has taken a prominent and active part in the affairs of three of the most prosperous and best known concerns in the United States. Mr. Blue, who resigns on account of ill health, will remain with the company in the capacity of director.

The Miller Supply Company, Huntington, W. Va., announces the appointment of M. E. Brown

as general manager, and J. H. Barry, sales manager, effective January 1.

John H. Davis has resigned as director and general manager of the Standard Steel Castings Company, Cleveland, O.

Lincoln Crocker, vice-president International Machinery Company of South America, with headquarters in Santiago, Chile, spent several days at Beloit, Wis., last week, to inspect the new oil engines being produced and marketed by the Fairbanks-Morse Mfg. Company. He has arranged for a large shipment of the engines to South America.

Charles J. Gibbons has been elected vice-president and manager of the New Milford Cold Rolled Steel Company, New Milford, Conn. This company has quadrupled its output under its new management.

A. C. Rulofson, president of the San Francisco Home Industry League and a prominent factor in the sheet-steel trade of the Pacific coast, has been appointed as a member of a committee of the league to visit China, Japan and the Philippine Islands to investigate trade conditions.

T. T. Roberg, for a number of years connected with the Crucible Steel Company of America and the Columbia Tool Steel Company, will be associated with A. Milne & Co. at their Chicago office.

Obituary

Sidney W. Hopkins

Sidney Wright Hopkins, former iron merchant, died at his home in New York City, December 12, aged 77 years. He was born in Newburgh, N. Y. Until 1901, when he retired from active business, Mr. Hopkins was a prominent figure in financial circles. Beginning his career in 1850, in the employ of T. B. Coddington & Co., importers of metals, at the age of 20 he was taken into the firm of Bunting, Bean & Co., metal brokers, and at 24 he became junior partner in his father's firm of E. A. & S. W. Hopkins, dealers in railroad supplies and negotiators of railroad and other securities. When his father retired in 1866 the son became senior partner in the firm of S. W. Hopkins & Co., establishing a London branch of the business.

Mr. Hopkins provided the first steady market in this country for old iron rails, by making annual contracts with shipping merchants in London and Liverpool for the transportation to this country at a uniform rate per ton of rails purchased by his firm in Europe, and by contracting with rolling mills in this country to supply them with old rails to their full yearly requirements at a fixed price per ton. The United States, at this period, was the largest consumer of old rails in the world. The rails were rerolled into new rails, thereby saving the expensive process of puddling.

Mr. Hopkins had close business relations with the late C. P. Huntingdon, who recognized and appreciated his brilliant constructive genius and business initiative. The brokerage firm of Fisk & Hatch was the authorized agent for the sale of Central Pacific bonds. The firm of S. W. Hopkins accepted Central Pacific bonds, in lieu of cash, in payment for rails, successfully negotiating the sale of these bonds in this country and Europe without interfering with the sales conducted by Fisk & Hatch.

Up to the day of his death Mr. Hopkins retained the quick mental processes of his youth, and, but for his failing health, he would undoubtedly, even in spite of his advancing years, have repeated some of his earlier successes. Among these were the financing of the People's Gas Light & Coke Company, Chicago, which he reorganized; the construction of the four railroads later consolidated as the Chicago and Grand Trunk Railway Company; the building and financing of the water works of Council Bluffs, Iowa; the purchase for colonization of half a million acres of mineral and agricultural lands in the West, etc. He was a member for 34 years of the finance committee of the board of trustees of the Dry Dock Savings Institution. He leaves a widow, a son and two daughters.

STEPHEN HARRIS HARRINGTON, Chicago, whose death December 20 was briefly referred to in *The Iron Age* of December 25, was born at Halifax, N. S., November 7, 1846. He received an academic and university training. He served during the civil war as a captain's clerk in the Union navy and at the end of the war located in Chicago. He was employed for a time as a clerk by Reed & Co., druggists, followed by clerical work with the Green Bay Transportation Company and in railroad offices. His career in connection with the manufacture of perforated metals began in 1869 and led to the organization of the Harrington & Oglesby Company, which company was succeeded by the Harrington & King Perforating Company, of which he was president and chief owner at the time of his death. From a very small beginning he developed the business of perforating until he became the most important figure engaged exclusively in the metal perforating trade. He was a resident of Highland Park, a suburb of Chicago, and was a member of various Chicago clubs.

CHRISTER PETER SANDBERG, a Swedish civil engineer, died Thursday, December 4, 1913, at his home in Sydenham, England. He was born in Venersborg, Sweden, and was 81 years old. His investigations of metallurgical subjects and his papers on rails, read before engineering societies in this country and Europe, attracted wide attention. He was one of the oldest members of the Institution of Civil Engineers and was also a member of the Institution of Mechanical Engineers and of the Iron and Steel Institute. He was a life member of the Société des Ingénieurs Civils de France. He was awarded the Telford gold medal for a paper on "The Manufacture and Wear of Rails" and decorated by his native and other countries for his distinguished services in regard to railroads.

JOHN TRACY HARRON, president of Harron, Rickard & McCone, machinery merchants, San Francisco, Cal., died December 16, after a brief illness, aged 54 years. After serving as apprentice with the Union Iron Works, he engaged in the machinery business with the former Parke Lacey Company, advancing until he became vice-president and general manager. On the death of B. T. Lacey in 1901, Mr. Harron, with the late Thomas Rickard and A. J. McCone, took over the business under the firm name of Harron, Rickard & McCone. He leaves a widow and a son.

HERMAN MEINHOLTZ, vice-president and superintendent of the Heine Safety Boiler Company, died at his home in St. Louis, December 25, after a short illness of heart trouble, aged 46 years. He was a graduate of the Manual Training School of St. Louis. He leaves a widow and five children.

HENRY KNELL, secretary of the Philadelphia Steel & Forge Company, and associated with D. G. Gautier & Co., 50 Church street, New York, ended his own life December 19 at his home at Glendale, L. I. The circumstances indicated mental derangement. He was 29 years old.

New Iron and Steel Works Construction.

(*Continued from page 31*)

Jones & Laughlins Steel Company

The main new construction work of the Jones & Laughlins Steel Company in 1913 was the following: At its Pittsburgh works, No. 2 Eliza blast furnace was completely rebuilt, relined and the capacity slightly increased. Nos. 4 and 5 Eliza blast furnaces were relined and a new stove was added to No. 2. The coal hoist at the South Side works was also rebuilt. At the Aliquippa works the new coke oven plant was completed, containing 600 ovens. A 3000-ton coal washer was also erected and a second Bessemer converter was installed in the steel works.

The company has completed and put into service 22 steel barges 200 ft. in length, each having a carrying capacity of 1000 tons, and is now having built a new steamboat, which it expects to have in service about March 1, 1914. These steel barges are used for hauling coal from the company's mines near Brownsville, Pa., and also for hauling material between the South Side works at Pittsburgh, and the Aliquippa works.

New work this company has under way and which it expects to complete early in 1914 includes the rebuilding of Soho blast furnace, with two new stoves and the relining of the third stove. At its Aliquippa works two new soaking pits will be added.

Maryland Steel Company

At Sparrows Point, Md., the Maryland Steel Company has the following new work under way: 120 Koppers coke ovens, with complete by-product equipment. Rebuilding of No. 3 blast furnace with skip hoist and modern stock handling appliances. Installation of five gas-driven blowing engines, with capacity of 25,000 cu. ft. of free air each. Installation of a 1000-ton metal receiver for serving the Bessemer department. Installation of an electrically-operated ingot stripper between the Bessemer and blooming mills.

Other improvements are contemplated but have not yet been undertaken. The reconstruction of No. 2 blast furnace along the same lines as Nos. 1 and 3 furnaces was completed in June, 1913, and the furnace has been in operation since that time.

Crucible Steel Company of America

Crescent Works: At this Pittsburgh plant there is under construction a concrete dock on the Allegheny River, which will be used for the handling of its entire supply of coal from the water. The coal will be elevated from a concete bin to hoppers for the automatic supply to the new battery of boilers recently erected at this plant, which will be fed by Playford stokers made by the Rosedale Foundry & Machine Company, Pittsburgh.

La Belle Works: A battery of boilers of 600-hp. units is being built and will be equipped with the Playford type of automatic stokers.

Syracuse Crucible Steel Works: This plant has been under erection at Syracuse, N. Y., for some months, and the buildings are now about under cover. It is planned to make it the largest and most complete crucible steel plant in the world, where only high quality crucible steel is to be made, and all the materials will be handled as nearly automatically as possible. Electric motors will take the place of steam engines and monorails and cranes will be used throughout the works in place of other kinds of distributers.

Atha Works: The turbine system is in use at this plant and through it the electric furnace has been supplied with power to make its initial product. It is contemplated to add an additional low-pressure turbo-generator in order to utilize the exhaust steam at the large hammers, now wasted. Through the use of this additional power some of the old steam engines running the mills will be replaced with motors.

Crucible Fuel Company: This company, an adjunct of the Crucible Steel Company of America, has consolidated its recent purchase of 2500 acres of coal in Greene County, Pa., with the 2000 acres of coal owned by the Crucible Coal Company. The whole operation hereafter is to be under the name of the Crucible Fuel Company. From these mines all of the plants of the Crucible Steel Company and its affiliated interests are to be supplied as fast as the output will permit. The Pennsylvania Railroad Company has completed an extension of its system into the property, so that hereafter coal can be shipped not only by river, but also by rail to all the mills owned by the parent company.

Aliquippa Steel Plant: During the year the works owned by the company at Aliquippa, Pa., formerly known as the Aliquippa Steel Works, have been dismantled, the machinery removed to the other works of the parent corporation and the buildings and ground sold.

Republic Iron & Steel Company

At its Haselton, Ohio, works the Republic Iron & Steel Company completed and put in operation in September, 1913, two open-hearth furnaces of 80 tons capacity each, giving a total of ten open-hearth furnaces of this capacity. It also completed and put in operation in July and August three mills, 8, 12 and 20 in. at its Brown-Bonnell works, on which it rolls merchant steel bars and light shapes. It added three new stoves to its Haselton No. 1 blast furnace. It is now building and expects to complete in April, 1914, 68 by-product coke ovens of the Koppers type, which will have a capacity of about 1000 tons of coke per day.

At the Pioneer plant of the company at Thomas, Ala., No. 3 blast furnace is now out of blast for reconstruction on the same lines as the Nos. 1 and 2 furnaces of the same group, both of which now have a capacity of close to 300 tons a day. A coal tipple and washer have been rebuilt at one of the company's mines near Thomas.

Brier Hill Steel Company

This company has nearly completed at Youngstown, Ohio, an open-hearth steel plant to contain seven 75-ton open-hearth furnaces and a 42-in. blooming mill. Two furnaces have been finished and put in operation, and the entire plant is expected to be completed in February or March. The output will be about 1200 tons of billets and sheet bars per day, and a good part of the sheet bars will be used by the company in its own sheet mills. It has been selling billets and sheet bars in the general market for delivery early in 1914.

Pittsburgh Steel Company

In the summer of 1913, the Pittsburgh Steel Company completed two blast furnaces at Monessen, Pa., each 90 ft. in hight by 22 ft. 6 in. Each stack is equipped with four McClure, three-pass fire brick stoves, 22 x 100 ft. The two furnaces were started in August, but one stack operated only a few weeks, when it was put out of blast and is still idle. The other furnace has been making an output in excess of its rated capacity of 500 tons.

Wheeling Sheet & Tin Plate Company

This concern completed and put in partial operation on Monday, December 15, a 10-mill tin plate plant at Yorkville, Ohio, which when running full is expected to turn out about 800,000 base boxes of coke plate per year. Five mills were started. A full illustrated description of this plant appears elsewhere in this issue.

Pittsburgh Crucible Steel Company

This company completed and put in operation at Midland, Pa., an open-hearth steel plant, containing eight 60-ton furnaces, of which six are basic and two acid, and provision has been made for two more. The plant contains a two-high type blooming mill, with rolls 40 in. between centers. The first steel was rolled on August 4, and when the entire eight furnaces are in operation, the plant is expected to make from 32,000 to 35,000 tons of billets and slabs per month, the greater part of the output being used in the finishing mills of the Crucible Steel Company of America, the parent concern, in the Pittsburgh district. The full illustrated description of this plant appeared in *The Iron Age* of November 6, 1913.

The Pittsburgh Crucible Steel Company has other improvements and additions under way at Midland, Pa., which will largely increase its output of finished steel and give it a wider line of products. This new work includes a Morgan continuous merchant mill, the roughing stand to be 14 in. and the finishing stands 12 in. to 8 in. This mill will roll ⅜ to 2-in. rounds and various squares and merchant flats. It will be contained in a building 120 x 900 ft. The company is also building a 24-in. reversing bar mill in a building 108 x 755 ft., the product to be from 2-in. to 8-in. rounds. The Crucible Steel Company of America has always been a large manufacturer of railroad springs, and on this new mill it will also roll steel car axles.

Other new construction includes a 26-in. motor-driven plow steel rolling mill to be contained in a building 79 x 820 ft., a coulter shop 118 x 400 ft. a foundry 131.5 x 240 ft., a machine shop 144 x 240 ft., a carpenter and pattern storage shop 48.5 x 165 ft., a storeroom and oil storage house 55 x 140 ft., combined laboratories 70 x 93 ft., and a sanitary building, brick sheds, etc.

Ashland Steel Company

This company is now remodeling its mill at Ashland, Ky., in order to roll sheet bars, concrete bars and billets of small sections. It is expected to have this mill in operation by March 1. An additional 400-kw. generator is being installed.

Gulf States Steel Company

The Southern Iron & Steel Company, Birmingham, Ala., which has a blast furnace steel plant and wire mill at Gadsden, Ala., and various other properties, has been wound up and dissolved in the past year and its creditors and a few of the stockholders have united in acquiring the properties for the purpose of future development. The business is now being handled under the name of the Gulf States Steel Company. Some plans for improvements have been mentioned, but are not in definite form as yet. Concerning the 100,000,000-ton deposit of self-fluxing ore in Shades Valley, recently purchased, it is stated that the rock slope, with an ultimate capacity of 2000 tons per day, has been sunk one-fifth of the entire distance. Some water was met with which was easily and successfully controlled by the direct cementation process.

American Rolling Mill Company

The new construction at the Middletown, Ohio, plant of the American Rolling Mill Company last year included the following: A gas producer plant for four open-hearth furnaces, equipped with Hughes mechanical gas producers, self-cleaning type, and coal handling and screening equipment; one 65-ton open-hearth furnace; one 4-hole soaking pit, and one sheet warehouse, 80 x 200 ft. Four additional houses for foreign labor were built, being the nucleus of an additional foreign colony, established for employees.

Other Steel Works Additions

The Sharon Steel Hoop Company, Sharon, Pa., has made slight additions to its power plant in the erection of two batteries of Babcock & Wilcox boilers and one 750-kw. General Electric generator driven by a cross-compound Southwark Corliss engine.

The Alan Wood Iron & Steel Company, Philadelphia, is about completing a new plate mill which has been under construction in the past year and expects to have it ready for operation early in 1914.

While the Page Woven Wire Fence Company has not made any extensive additions to its plant at Monessen, Pa., in the past year, it has increased its capacity somewhat and has improved the physical condition of the property in many ways.

The Eagan-Rogers Steel & Iron Company Crum Lynne, Pa., is now planning to build a large pattern storage and pattern shop. It is also having plans drawn up for additional annealing furnaces, new sand blast room and additional equipment.

The American Iron & Steel Mfg. Company is adding an electric furnace department in which to refine the metal from its new open-hearth furnaces. The equipment will consist of two 20-ton Frick induction furnaces, double-ring, single-phase; they are a new type of this inventor's design. The furnaces will be furnished by the Siemens & Halske Actiengesellschaft, 90 West street, New York, and the completion of the plant is expected by the late summer of this year. It will be the largest electric steel plant yet constructed.

THE STEEL CORPORATION

Indiana Steel Company

The 36-in. slabbing mill which was begun at Gary late in 1912 is still under construction. It will provide slabs for the 60-in. universal plate mill at Gary as well as for the two jobbing plate mills of the American Sheet & Tin Plate Company. By relieving the blooming mill of the breakdown operations for the plate mill it will be equivalent to increased capacity for the latter. In the No. 2 power house the four 3000-kw units under construction a year ago, consisting of electric generators and gas engines using blast furnace gas, have now been completed, making 10 in all. The installation or waste heat boilers for 28 open-hearth furnaces at Gary is substantially completed and some of these boilers are in operation. They furnish steam for blowing the gas producers and will also supply steam for the slabbing mill engines. This is the first considerable use of waste heat boilers with open-hearth furnaces in this country. Tar burning apparatus was installed in 1912 at two open-hearth furnaces at Gary and the

use of tar in this way has been somewhat extended in the past year.

Illinois Steel Company

Two 50-ton open-hearth furnaces have been completed at the No. 1 open-hearth plant at South Chicago and four 35-ton furnaces have been rebuilt, bringing them up to a capacity of 45 tons each. The work of remodeling the rail mill at South Chicago has been under way for some time and it will be equipped to turn out sheet bars and billets, a finishing end for sheet bars being added and handling arrangements provided for both sheet bars and billets. It will now be possible to roll billets simultaneously with rails. The essential features of this change are an arrangement of the rolls of the roughing stand so that in this stand not only the roughing passes are given the rails but also the finishing passes for billets, the passes being made concurrently. The mill tables are then arranged for the separation and distribution of the billets and the continuation of the rails through the subsequent processes of rolling.

The storage capacity at South Chicago ore docks has been enlarged, providing room for a good many thousands tons of additional iron ore. At Joliet four new stoves have been built at blast furnace No. 1. At the North Works at Chicago the company is replacing all its wooden structures —fabricating buildings and storage warehouses— with fireproof buildings. These are well along toward completion.

An important new building the Illinois Steel Company has under construction is an extensive warehouse and distributing plant at St. Paul, Minn.

Carnegie Steel Company

Enlargements and new construction work completed by the Carnegie Steel Company in 1913 include the rebuilding of No. 1 Clairton blast furnace at Clairton, Pa., on new lines, and other improvements were made, which increased the capacity of the stack from 450 to 500 tons per day. It was blown in September 22, 1913. The same improvements are now under way at No. 2 Clairton blast furnace, which will be blown in in early 1914. No. 1 Carrie blast furnace was also reconstructed on new lines, the capacity increased from 450 to 500 tons per day, and the stack was blown in on June 1, 1913. Carrie No. 2 was also rebuilt and the capacity increased from 450 to 500 tons per day, the stack being blown in March 1, 1913. At the Edgar Thomson blast furnaces at Bessemer, Pa., gas washing equipment serving the entire 11 furnaces was installed.

At the Clairton steel works two new 60-ton open-hearth furnaces were completed and made the first steel January 7, 1913. At the Edgar Thomson Steel Works at Bessemer a new open-hearth plant, containing 14 80-ton furnaces was practically completed. Seven of the furnaces are in operation, the first steel having been made on August 16, 1913. An illustrated description of this plant appears elsewhere in this issue. At the Duquesne steel works at Duquesne, Pa., gas producer equipment for 14 open-hearth furnaces is being installed, and will be completed early in 1914. This will permit of using either natural gas or producer gas. Also, at the Duquesne steel works a new 10-in. merchant bar mill is under construction, with a capacity of 10,000 tons per month, and will be completed early in 1914. At the Edgar Thomson steel works at Bessemer the new blooming and rail mills, the construction of which was begun in 1912, will probably be finished in the summer of 1914. At the McCutcheon works on the North Side, Pittsburgh, a new 8-in. hoop mill was built and was started July 21, 1913. Additions to equipment in existing works were as follows: Edgar Thomson works, 4,000-kw., 660-volt a.c., live steam turbo-driven electric generator, for use in connection with new construction. Homestead steel works, 5000-kw., 660-volt a.s., exhaust steam turbo-driven electric generator, to reinforce existing facilities.

At the Farrell, Pa., works two more open-hearth furnaces have been equipped for the use of tar as fuel.

American Steel & Wire Company

At the Donora works a new 60-ton open-hearth furnace has been completed and put in operation.

At the Cuyahoga plant in Cleveland additional buildings and equipment are being provided to increase the output of cold rolled material.

The new rod and wire mills in the Birmingham, Ala., district, located at Fairfield, Ala., one and a half miles from the Ensley steel works, are now being put in readiness for operation. Some rods may be rolled early in February. A number of heavy steel cars have been provided for hauling billets from the Ensley plant. The Fairfield plant will all be electrically operated, current being received from the central electric power plant at the Ensley works.

Tennessee Coal, Iron & Railroad Co.

An additional turbo blower is being installed at the blast furnace plant at Ensley. It has a capacity of 40,000 cu. ft. of air per minute. Two turbo blowers are already in use at this group of furnaces.

American Sheet & Tin Plate Company

Two open-hearth furnaces of 60 tons capacity have been completed and put in operation in the past year at the Apollo Works, Vandergrift, Pa. At the Shenango Works, New Castle, Pa., ten additional squaring shears have been installed and a new annealing furnace provided. At the Sabraton Works, Morgantown, W. Va., an addition has been built to the tin house building and four new tinning stacks have been installed.

Minnesota Steel Company

As indicated in *The Iron Age* of September 18, 1913, the new works near Duluth will probably produce its first steel in the spring of 1915. Construction work has been actively under way in the past year. Work was begun in 1913 on three additional 75-ton open-hearth furnaces, which will make 10 in all, with an annual capacity of about 500,000 tons. The two blast furnaces are well along, the brick lining having been completed before the advent of cold weather. Good progress has been made in the construction of the 90 Koppers by-product coke ovens.

National Tube Company

A very considerable appropriation was made last year for the installation of threading machinery and for other improvements at the Pennsylvania Tube Works, Pittsburgh. A 144-ft. extension for the boiler shop building was completed at the Lorain, Ohio, plant. At the Kewanee works, Kewanee, Ill., a new boiler plant of 4000 hp. capacity was completed and put in operation.

Canadian Steel Corporation, Ltd.

The plans as outlined in the past year for the new Canadian plant at Ojibway, Ontario, call for two or three blast furnaces, an undetermined number of open-hearth furnaces, and rail, structural, bar, plate and wire mills. It is expected that work will begin in the coming spring, and the probability is that the wire plant will be built first. The company now has a wire fencing plant at Hamilton, Ontario, to which wire is shipped from works on this side the border.

BLAST FURNACE WORK

The Thomas Iron Company has completed two new trestles for unloading ore and other raw materials at its Saucon furnaces, Hellertown, Pa. The piers are concrete, and the stringers are steel I-beams. No. 10 furnace at Hellertown was relined last year and is ready to go in blast. Lock Ridge furnace No. 7, at Alburtis, Pa., was blown in on a new lining November 6, 1913. The furnace is 60 ft. by 14 ft., and the fuel is all anthracite. Lock Ridge furnace, No. 8, was blown out December 11, 1913, and will have to be relined. No. 3 furnace at Hokendauqua was blown out May 2, 1913, and will be repaired and relined throughout. At its Richard mine, near Wharton, N. J., the company is installing electric centrifugal pumps to replace the many old steam pumps.

The Northern Iron Company will install a new condenser at its blast furnace at Standish, N. Y., early in 1914

The Reading Iron Company has extensively remodeled its Keystone blast furnace at Reading, Pa., in the past year, equipping it with a double skip hoist and providing a new bin system. A description of these changes will be given in a later issue.

The E. & G. Brooke Iron Company, Birdsboro, Pa., is installing a new 588-hp. Rust boiler at its No. 3 blast furnace. An important development in this company's operation is the work now under way for the reopening of the French Creek iron mine at St. Peters, Chester, Pa., a property which it operated up to 1898. At that time the mine was shut down because of the difficulty of properly roasting the ore, its sulphur content making it troublesome and expensive to work in a blast furnace, compared with the good Lake ores then sold in the Eastern market at much lower figures than have since been obtainable. The ore runs about 55 per cent. metallic iron, with phosphorus 0.03 per cent. and sulphur about 2.50 per cent. For desulphurizing the ore, a crusher and rolls will be installed to reduce it to ¼ in. size and under, after which the material will be passed over a Dwight-Lloyd sintering machine, thus bringing the sulphur down below 0.15 per cent., and making a satisfactory product for use in the furnace. The new equipment for the mine consists of two 151-hp. Babcock & Wilcox boilers, an Ingersoll-Rand air compressor and a Wellman-Seaver-Morgan hoisting engine.

The Wellston Steel & Iron Company, Wellston, Ohio, put up a new furnace stack and hoist house last year to replace the old Milton stack that was built in 1872. The new stack is the same size as the old one.

The Iroquois Iron Company, which now has four blast furnaces at its South Chicago, Ill., plant, added last year a large type Hoover & Mason ore bridge.

The Federal Furnace Company added a new Baldwin locomotive to the equipment of its blast furnaces at South Chicago and installed another strand of molds on its pig casting machine. A number of new safety appliances have been provided at different parts of the plant.

The Rogers-Brown Iron Company, Buffalo, owner and operator of the four Susquehanna furnaces at South Buffalo, N. Y., has completely equipped the Rogers iron mine (of the Munro Iron Mining Company, a subsidiary corporation), located near Iron River, Mich., and the property has been put on an operating basis.

A plant was built last year at the Sharpsville, Pa., furnaces of the Shenango Furnace Company for the purpose of making commercial the slag product. The company's plans for 1914 include the possible reconstruction of No. 1 blast furnace.

The Marting plant of the Marting Iron & Steel Company, Ironton, Ohio, was out of blast from May 1 until November 13, 1913. During this time the furnace was relined and the plant equipped with steel trestles, bins, skip hoist, and a complete mechanical filling apparatus. In the past summer the company also added steel trestles and bins at its Ironton plant. This furnace will probably go out of blast within two or three months, and will then be equipped with a skip hoist. The company's Lawrence plant at Culbertson, Ohio, was relined in the early part of 1913 and has been operated steadily on basic iron. This furnace was rebuilt on larger lines and is now producing about 225 tons of basic iron per day.

The Woodward Iron Company, Woodward, Ala., is just completing a furnace 22 x 90 ft. which is expected to produce 400 tons of iron per day. This furnace carries with it five stoves and all the other necessary equipment. The company has increased its by-product coke plant from 60 to 140 Koppers ovens with an output of 2100 tons of coke per day. An improvement planned is the construction of a coal-washing plant that will wash 2000 tons of coal per day. The company contemplated putting in three turbo blowers, one for each of its blast furnaces. It has, however, purchased two reciprocating engines from the Mesta Machine Company for the new furnace in order that more time might be had for developing the turbo blowers. Ultimately it will probably blow all its furnaces with turbo blowers and hold the reciprocating engines as spares.

NEW ROLLING MILL WORK

The Apollo Steel Company, Apollo, Pa., completed its new electrically-driven direct-connected sheet rolling mill in June, 1913. The main building, which is of depressed bay construction, is 504 ft. long and 156 ft. wide. The roll drive consists of a 1400-hp. motor, running at a speed of 240 r.p.m., and two flywheels and gearset, transmitting the power to the mill shaft at approximately 30 revolutions. The annual output is about 30,000 tons of black, galvanized and corrugated sheets, Nos. 10 to 30 gauge. The plant, which is unique in several particulars, was fully described in *The Iron Age* of June 26, 1913.

The Phillips Sheet & Tin Plate Company completed last year at its Weirton, W. Va., plant an additional power plant, comprising about 6000 hp. in the boiler plant and about 3000 hp. in the electric plant. In September it finished and put in operation a plant for rolling cold rolled strip steel, having a capacity of about 2500 tons a month and representing an outlay of $750,000.

The new plant of the Trumbull Steel Company, Warren, Ohio, was started up on July 31, 1913. A complete description appeared in *The Iron Age* of September 11, 1913. There are 12 hot mills, six

for rolling sheets and six for rolling tin plate; 13 stands of cold rolls, four single and six tandem; and it is equipped with three galvanizing pots and 20 tin pots. The annual capacity is 60,000 tons of sheets and tin plate.

The most important construction of the A. M. Byers Company at its Pittsburgh works in the past year was the erection of a modern galvanizing building. It is of brick and the columns and frame girders are concrete, reinforced with structural steel. A ventilator on the roof runs the entire length of the building and this with the liberal window space gives sufficient air to carry away all the fumes. The company is using the hot metal process, which consists of first pickling the pipe in a bath of diluted sulphuric acid to remove the scale, grease, etc., and then removing the acid from the pipe by a water bath. After the water bath, the pipe is immersed in a tank of muriatic acid, which is dried on the pipe. The pipe then goes into the galvanizing kettle for its coating of spelter. In the pickling an agitating device is used in connection with a 15-ton Cleveland crane, which turns each batch of pipe, exposing all parts of the outer surface to the action of the acid. Two 20-ton Fairbanks scales have been installed to weigh all pipe when black, after pickling, and when galvanized. A large receiving building has been provided to keep each incoming car of spelter separate, until a chemical analysis has been made. The capacity of the new plant is 70 per cent. greater than that of the old.

NEW CONSTRUCTION IN CANADA

Algoma Steel Corporation, Ltd.

During the year 1913 this company expended a large amount on further additions and improvements to its steel plant at Sault Ste. Marie, including steel trestle and storage accommodations for coal, limestone and pig-iron stocks, additions to blast furnace pumping plant, new cupola for open-hearth department and a large addition to its rolling stock equipment.

Arrangements are nearing completion for the erection of several additional open-hearth furnaces in the coming year, as well as a new 7½-ton ore bridge, also improvements to the gas engine power house. At the Magpie mine the ore roasting plant is being enlarged and when completed will have a daily production of 1000 tons of treated ore. The hydro-electric power plant at the Sault has also been improved and further improvements are now under consideration which will involve a large expenditure.

Canada Steel Company, Ltd.

In August much of the plant of the Canada Steel Company, Ltd., Hamilton, Ontario, which rolls bars and special shapes, was destroyed by fire. It has been thoroughly rebuilt and is now running well. The company has erected a new brick and reinforced concrete roll and machine shop, 60 x 120 ft., completely equipped with all necessary tools for doing its own repair work. It has also built a new shipping end to the plant, 60 x 250 ft. with crane runway the entire length. The crane handles all the finished material directly from the shears into the cars. The company has also rebuilt the main mill building and erected a new power house, installing a new 500-hp. motor. It is erecting at the present time an 8-in. mill with an independent roughing. All the machinery for this extension has been bought and is on the ground and it is expected to have all the improvements completed by February 1, 1914.

Steel Company of Canada, Ltd.

The Fort William, Ont., wire plant of this company is approaching completion. The buildings include the following: Cleaning house, 70 x 125 ft.; wire mill, 100 x 150 ft.; nail mill, 100 x 260 ft.; with a basement, 100 x 150 ft.; warehouse for raw materials at dock, 75 x 200 ft.; warehouse for finished goods, 65 x 226 ft. With two loading tracks this warehouse can be extended according to the growth of the business. All the buildings are of concrete, steel and brick, with metal window sashes. The capacity of the wire mill is 150 tons of finished wire per day. The mill was designed with a view to reducing costs in handling product to the minimum. The ground plan allows for extensions when required to double the capacity of the mill. The boiler house and transformer station are centrally located. Two 150-hp. boilers are installed for heating purposes only. The mill will be run by electric power and the initial installation of motors will be from 400 to 500 hp.

Nova Scotia Steel & Coal Company

This company completed a 50-ton stationary open-hearth furnace at its Sydney Mines plant, which has been producing steel regularly for the past five months. The fuel used is gas made in the Chapman rotary producers, which are giving very satisfactory results. The output in all the iron and steel departments of the company showed an increase for the year of about 10 per cent. over that of 1912.

Dominion Steel Corporation, Ltd.

The work done on the plants of the Dominion Steel Corporation, Ltd., at Sydney, Nova Scotia, in 1913 was almost wholly confined to the completion of the extensions previously undertaken. The record for the year covers the following: In January and February two 500-ton mixers fully equipped to be operated as open-hearth furnaces were brought into use. In March the new bar and rod mill designed and constructed by the Morgan Construction Company, Worcester, Mass., was started. In April a sixth blast furnace, nominal capacity 300 to 350 tons per day, was blown in.

Much work was done in extending the existing equipment to provide for increased tonnage. New gantry and other cranes, galvanizing and annealing plant, additional tracks, locomotives and cars for railroad service, etc. Two steamers were purchased for the Black Diamond Line and its service extended to Fort William, Lake Superior. A small emergency hospital is nearly completed. At the Wabana Mines, Newfoundland, additional shipping facilities have been provided, and the limestone quarries at Port au Port, Newfoundland, were completely equipped and brought into full operation.

On the coal plant the permanent equipment of the new collieries has been pushed on; these comprise Nos. 15, 16, 22 and 23; the Victoria Mine, known as No. 17 and No. 11 colliery were reopened. The general electric power station at Waterford Lake has been extended to provide for the new collieries; many houses have been erected and the foundations prepared for a hospital at New Waterford to serve the Lingan mines. A new high-level pier was completed and brought into service on Sydney Harbor. The Baum washing plant there was extended and improved and the tracks and equipment of the Sydney & Louisburg railroad were improved and extended.

The Machinery Markets

Despite the present dullness, which is consistent with the season, a more optimistic spirit pervades nearly all of the machinery trade and the worst that is predicted in any market is a continuance of slow buying until spring. In several cities the belief is that an improvement will come much sooner, in fact Chicago is on a normal basis already, if the lessened demand from the automobile industry is not considered. The trade generally is buoyed up by the fact that 1913 when summed up is shown to have been a good year.

General Review of 1913

Considering the amount of prospective business carried into 1913, the year might have achieved a great record had it not been for several unusual adverse influences which developed to halt buying. As it was, the trade did well, and complaint is justified only of the last four months of the year. The restraining factors included the new tariff and the discussion leading up to its enactment, although, in the eyes of the trade, an even more potent deterrent to sustained activity was the currency revision agitation, while other elements were the imbroglio with Mexico and the railroad freight rate question. With the tariff question settled, so far as changing the law was concerned, the others grew in importance.

The year did not have a surfeit of large machinery lists, although some important group purchasing was done by a few of the railroads and the United States Government. The latter bought tools and equipment amounting in the aggregate to an enormous sum, principally for the Pearl Harbor, Hawaii, and the Mare Island navy yards. There was a more or less steady volume of buying for two-thirds of the year. Some of the railroads and industrial companies which in previous years bought large aggregations of tools, in the good months of 1913 were steady buyers of one or a few tools at a time, and the effect was that while their business was just as great as formerly, it did not look as large. But when each month's sales were totaled the bulk of transactions often caused surprise. The export trade was good until fall. In the course of the year a large amount of second-hand machinery came on the market, which was still another detriment to sales by manufacturers and dealers. Another influence which tended to restrict sales was a more conservative tendency on the part of automobile manufacturers. Builders of motor trucks in particular became of less importance as buyers, while in various parts of the country one small truck company after another retired from business.

First Eight Months Were Good

While activity was slow in getting under way in the early part of the year, hopes were realized before many weeks had passed. Except for the usual easing up now and then, the succeeding months, until about the middle of September, were good. The piecemeal style of buying was traceable to the real or imaginary uncertainties of the year. In April business was retarded by increased apprehension over the tariff, and deliveries all over the country were hampered by the disastrous floods in Ohio, which not only impeded railroad travel, but submerged many plants. At times in the year many machine tool manufacturers were months behind in deliveries. In May the tariff question became an even more active influence, but the month turned out to be a good one. June brought an improvement, which soon subsided, but manufacturers had orders enough to keep them busy for several months. In July the effect of the currency agitation became more of a factor, but business remained good. August was still better, and the first part of September was fair, despite the fact that the reduced tariff was to become effective October 4. Then came the slower demand, more or less irregularity, and finally the quiet amounting at times to absolute dullness, especially in the machine tool trade, other lines of the metal industry holding up much better.

The Outlook for Railroad Business

Letters received by *The Iron Age* from over seventy railroad executives do not contain many specific promises that their roads will purchase shop equipment freely in the next six months. It should be remembered, however, that in previous years buying ran far ahead of the amount which the higher officials had been willing to predict. Then, again, in many cases just what machinery is to be purchased has not been determined. The inevitable wear and tear on shop tools of itself assures the making of a great many replacements, though these can be deferred if the railroad heads decide that retrenchment is necessary. This has been the experience in the last few months to a considerable extent. In one case where buying was imperative the president of the company personally superintended the buying, instead of relying on the purchasing agent. It is understood that the business was placed at figures so low as to be unsatisfactory to the trade.

Inquiries were made by *The Iron Age* as to probable new shops, extensions to those now existing, and replacements of machinery, and whether in the opinion of the official addressed there was likely to be an improvement in demand before July 1. Many have replied that much hinges on how the Interstate Commerce Commission treats the request of the railroads for an increase in freight rates, while others point out that a general improvement in financial and business conditions must occur before the railroads will be prominent factors in the market. Not a few expressed the opinion that there would be little improvement in the next six months.

Some Opinions From Executive Officers

From the replies received the following extracts are taken:

Atchison, Topeka & Santa Fe: Until the money market eases up materially there is no prospect of improvement or extension work on any large scale, and on such work depends, of course, equipment purchases in a large way. Our purchases in the first six months of next year will not equal purchases in periods of expansion; they should, nevertheless, run along at a satisfactory and normal rate.

Alabama Great Southern: It so happens that the Cincinnati, New Orleans & Texas Pacific and the Alabama Great Southern purchased and contracted for, during the year 1913, a large amount of machinery for use at Somerset, Chattanooga, Birmingham and similar shops. * * * We have endeavored to anticipate our needs for the next two or three years by making this large investment.

Baltimore & Ohio: Our activities for the coming year will depend so much upon the general business situation that it is not possible at present to give much information. We have in mind a number of improvements which we hope to make if we seem to be warranted in doing so, though none of them is of any considerable magnitude.

Carolina, Clinchfield & Ohio: This company will make some extension of its shops and will be a purchaser of some new machinery. As our railroad was recently constructed and as our shops are new, replacements will be few, and the only purchases will be to meet the demands of increasing traffic. We also will purchase during the coming year from 500 to 1000 additional coal cars of 70 tons capacity, together with several Mallet and several Pacific locomotives. * * * Should general conditions remain about as at present, I should not look for any increased demand from the railroads. Should conditions change for the better, as, for instance, the relaxation of the tension in the foreign situation, the adoption of an advanced policy of for-

giveness and correction in the attitude of the Government toward corporations, and particularly the allowance of increased freight rates, I should expect an early and substantial improvement in the demand from the railroads.

Chesapeake & Ohio: It is not the intention of either the C. & O. or the Hocking Valley to make any considerable purchases of machinery or to build any new shop extension at this time.

Chicago & Northwestern: We are just completing the installation of tools and machinery in our new shops at Clinton, Iowa, at a very considerable expense, and have nothing contemplated for the first six months of 1914 beyond the usual repairs.

Delaware & Hudson: We have completed the shops started early in 1912 and do not contemplate any further extensions or new work of that character at present. I regret that under present conditions I can hardly feel optimistic. * * * On the other hand, I believe that if the application of the roads to increase their freight rates is granted it will be a factor in clearing the situation.

Delaware, Lackawanna & Western: This company has made extensive expenditures in the past few years for the construction of new shops and their equipment with most modern and efficient machinery, and therefore we do not contemplate any extensive enlargements or machinery replacements.

Duluth, South Shore & Atlantic: This company has during the past year made very extensive additions to our shops and in placing machinery, but we do not contemplate any expenditures of this kind during the coming year.

Erie Railroad: This company's contemplated additions and replacements of machinery for the ensuing year are so small as to have no effect whatever on the supply.

Florida East Coast: Our demand upon machinery people in the first half of 1914 is not likely to be any larger than for the first six months previous.

Georgia Southern & Florida: We have in the past year equipped our Macon shops with modern machinery, electrically operated, which will take care of our requirements for some time to come.

Illinois Central: Is equipping new shops at Nonconnah, Memphis, Tenn., with machine tools, power house and mill building equipment as follows: One 36-in. vertical drill press; one 40-in. x 18-ft. engine lathe; one 24-in. x 10-ft. engine lathe; one 1½-in. double head bolt cutter; one 24-in. crank shaper; one double-head emery grinder; one combination triple punch and shear; one 2½-in. pipe machine; three 72-in. x 18-ft. 150-hp. fire tube boilers fitted with Burke furnace; two boiler feed pumps; one feed-water heater; one washout system complete; two 1200-ft. duplex Laidlaw-Dunn-Gordon air compressors. The old machinery in the mill building at Memphis is to be removed and arranged for group and individual drive.

Intercolonial, Canada: In the early months of 1914 we will purchase about $20,000 worth of tools.

Kanawha & Michigan: This company is just completing some additions to its shops at Hobson (Middleport, Ohio), including an electric power plant in lieu of steam and a new shop for use in connection with freight repairs. There still remain to be provided a few additional shop tools.

Minneapolis & St. Louis: Restoration of prosperity and commercial activity will follow with improved conservative regard for property rights, fair treatment of capital, advances in railroad rates to give stability to the value of their securities and currency legislation to meet the needs of the country.

Missouri & North Arkansas: This company has just completed extensive betterment work in the way of new shops and terminals, located at Harrison, Ark., and has moved the old shops, which were located at Leslie, Ark., to Heber Springs, Ark. About $40,000 worth of new shop tools was purchased for Harrison, as well as complete power plant equipment, and I doubt therefore whether we will make any purchases of shop tools in the coming year.

New York Central: The needs of our lines for the first six months of 1914 will approximate the requirements of the corresponding period of 1913, but the ability to satisfy these needs is dependent, of course, upon our success in raising the necessary capital, which is not very encouraging at the moment.

New York, Chicago & St. Louis: In my opinion, the present situation and the future outlook are such as to require the most rigid economy in every direction on the part of the railroads and, such being the case, we are not contemplating any shop improvements, extensions or replacements of machinery.

Norfolk & Western: There will be no special purchases of shop equipment in the coming year. If business justifies it we may extend our erecting shop at Roanoke to some extent.

Northern Pacific: Our programme for next year's improvements has not yet been made. At best, our purchases will be very small, as we have done a great deal of work in the direction of shop improvements in the past few years.

Philadelphia & Reading: I doubt very much whether this company will be in the market for any shop equipment for some time to come. We have just completed a car shop at St. Clair, the tools for which are already purchased, I believe. * * * No new work of any kind is contemplated until such time as the financial conditions throughout the country are better than they are today.

Pennsylvania: We do not authorize our programmes for tools and machinery until some time in March.

Pennsylvania Lines West: Unable to give any information of value as to possible purchases of shop equipment during the coming year. Business conditions seem to be rapidly changing and such plans as we have in contemplation will be adjusted to the business situation as it may develop.

Southern Pacific: We contemplate no new shops, extensions or replacements of machinery now or in the near future. The demand from the railroads for the first six months of 1914 will depend, in my opinion, very largely on their surplus over operating expenses and taxes. Both of these items have increased so rapidly in the past few years as to deprive the railroads of much of the money which they formerly had available for extensions and betterments.

Transcontinental, Canada: Completing at Quebec locomotive and car shops to be known as the Leonard shops. The work of designing, laying out and planning the entire plant is in the hands of W. J. Press, of the Commissioners of the Railways, Ottawa. The new shops will consist of 11 buildings in all, including locomotive, erecting, machine and boiler shops (under one roof), forge shop, freight car shop, power house, planing mill, dry kiln, lumber shed, forge stores and scrap bins, oil houses, stores building and office building for the executive staff. The total area covered will be 5½ acres. Mr. Press stated December 17 that it will be some time before specifications for the locomotive and car shop equipment will be ready.

Virginian: Has made heavy expenditures for new tools for its shops in the past two years and additions in that line will probably not be needed.

The Year in the New York Market

Like the rest of the country, the New York trade began the year in an optimistic frame of mind because of the several good inquiries in hand. Orders from the railroads were slow in coming, but January was fair and February good. Excellent business was done in April, and May also, despite growing fear of the tariff. In May the great list of the Government for equipment at the Pearl Harbor Navy Yard came out. June was somewhat quieter, but July proved a good month, although complaint was heard that collections were not as satisfactory as theretofore. August was better than July. In September orders ran fairly well in the first few days of the month. October was disappointing, manufacturers showing a growing tendency to purchase only what they found absolutely necessary. In this month sales of second-hand machinery became more plentiful and a source of worriment to sellers of new machinery. In November dullness became more pro-

nounced and some New York dealers conceded that they would be fortunate if their sales for the year equaled those of 1912. December was slow and became more so as the holidays grew near.

The Week

NEW YORK, December 30, 1913.

Extreme quiet marked the last week of the year, with the trade trying hard to be hopeful that the early future will bring a revival of activity. A better tone undoubtedly exists, though there is little to definitely indicate how soon and in what volume betterment in sales will come. The adoption of the new currency system is pointed to as one reason why buying should be resumed on a more normal basis, as its influence already has helped to create a better sentiment. A year ago machinery men were strong in their belief that they would not have to wait long for good business and their optimism proved to be well founded. This year they are far from being so confident, although they are hoping for considerable deferred business to come to an issue before many weeks have passed. In the holiday week some sellers did not press hard for orders, but took advantage of the slow season to get their sales organizations together and talk over conditions, plans and methods. At least one local firm did what it considered a fair business, in view of the general inactivity. It is admitted, however, even by this firm, that the month was below normal when compared with other Decembers. With most of the trade repair orders furnished the preponderance of business.

The Mica Insulator Company, 68 Church street, New York City, is receiving bids through its architect, W. L. Stodart, 30 West Thirty-eighth street, New York, for a three-story factory, 50 x 200 ft., with one-story wing, 50 x 130 ft., which it will erect at Schenectady.

The General Electric Company, Schenectady, N. Y., will order a few machines and a tumbling barrel, for which it has issued specifications.

The Queen City Foundry Company, Buffalo, has completed plans for a one-story foundry building, 100 x 200 ft. Tumbling barrels and other foundry equipment will be required. J. G. Gauthier, 445 Crescent avenue, Buffalo, is general manager.

The new foundry plant of the Otis Elevator Company, 120 x 423 ft., Buffalo, is nearing completion and will soon be ready for the installation of machinery and equipment, of which a large amount will be required. John Dillon, Girder street and Northland avenue, Buffalo, is the manager.

New England

BOSTON, MASS., December 29, 1913.

The year in New England has been one of sharp contrasts in the machinery and supply trades. Business was good in the first six months. The 12 months ended November 1 broke sales records for some houses manufacturing machine tools and kindred lines, including supplies. The natural falling off incident to the hot weather was followed by a certain degree of revival, but the influence was not important, and then came the weeks of dull trade. Promising prospects failed to materialize and inquiries became far from numerous. The banks began to draw in their resources, and people who wanted to go ahead with extension of their facilities were compelled to postpone their activities. Yet the symptoms of a protracted depression did not make themselves evident. Building construction has continued in a substantial way. A considerable, though not great, total of building for manufacturing purposes has begun in the last two months, or is announced to be carried out in the spring. The hardware people of Connecticut speak with encouragement, basing their belief upon a present very fair business and upon the reports of their representatives in various parts of the country. The wire mills and the factories which manufacture the almost innumerable products made from wire have slowed down perceptibly, but better business is expected. The same is true of the brass mills and the factories where that material is cut up.

In the machinery trade proper, cancellations have not been numerous; at any rate no mention is made of them. Also, price cutting has not been a conspicuous factor, very little complaint being heard—in fact, no more than usual.

Everywhere stocks are low, both of raw materials and finished products. Neither manufacturer, jobber nor retailer is heavily loaded up. The hand-to-mouth method of buying has been adopted so generally in the last few years that no great time can be required for working off stocks. The moment buying begins in a large way at any point in the line, the beneficial effects upon industry should be almost immediate. It used to be very different. In the period following 1907, for example, the great accumulation of stocks had to be got rid of before manufacturing industries felt the real influence of renewed activities.

The machine tool industry itself is decidedly dull. Many men have been laid off and some plants are running on short time. Some concerns are manufacturing for stock, but not in a big way. As usual of late years, the farther a machine tool manufacturer is from a special type of product the duller his business when things slump off.

At the present time, in a period which normally is one of the quietest of the year, a slight improvement is noted. Letters sent out by a machine tool builder to fellow manufacturers and to dealers have received some encouraging answers. According to these reports, Detroit and other automobile centers are feeling better. The builders of motor cars believe they will dispose of a product as large as ever, and they will buy new equipment. One machine tool builder says: "For the last two months business has been exceedingly quiet and there is very little inquiry at this time but plenty of indication that there will be considerable improvement after the first of the year." Another statement, from the milling machine industry, is: "While November was not quite equal to October, we have reason to believe that from now on business will slowly improve." Occasional instances of a change for the better are reported in the lathe and other lines of the older standard tools.

The builders of strictly special metal-working machines have had a good year, the demand for automatics to fashion wire and strips into various much-used specialties having been large. In fact, in the machinery trade generally the automatics have shared with the grinding machine and milling machine people an exceptional prosperity. An illustrative case is that of a large manufacturer of milling machines who wrote recently: "Our own factory is not suffering, as we are working full time with a full force of men. We actually have more men than we have ever had before. We are, however, accumulating a little stock of some sizes, but have not yet caught up with our orders with the entire line." A large company specializing on grinding machines found November a very good month indeed, with some slight decrease in the first half of December, and good prospects ahead.

The textile machinery industry, which is largely centralized in New England, is more prosperous than the average of several years. There are exceptions, chiefly in some types of woolen machinery, the product of which is injured by existing fashions. The demand for silk machinery has been phenomenal all the year, and continues on the same high plane. The cotton industry generally is prosperous and this condition is shown in the demand for equipment. Replacements of antiquated machinery have become a factor of some importance, impelled by the reduced tariff schedules. The paper machinery shops are fairly prosperous.

New England has been hit hard in 1913 by the revelation of conditions existing in the New York, New Haven & Hartford and Boston & Maine railroad systems, which have been compelled to pass their dividends and to plan retrenchments which should affect their buying for the next year or two. It is presumed that the great repair shops which have been contemplated for several years, for the western end of the New Haven system, will be deferred, though economy might result from a replacement of some of the road's existing repair facilities.

The Week

The year is going out with a marked change in general sentiment as to future business, as compared with the somewhat despondent attitude that has characterized the past two months. Manufacturers express a very hopeful feeling, and bankers agree with them. The general impression is that trade should revive sharply, the final settlement of the two great issues of tariff and currency having been accomplished. The change in sentiment is impressed upon the inquirer in many ways. Men who are not usually optimistic are now expressing the belief that 1914 will be a good year. Instead of a more or less insistent argument that the depression is a serious affair, threatening a prolonged continuation, one hears honest statements that recent information from representatives and customers is indicative of a change early in the year. This is true in most if not all lines of the metal industry; in fact, in all lines of manufacturing, except a few which are governed by extraordinary circumstances.

Announcement of new manufacturing development is naturally very small. Such is usually the case in the holiday week, and with business none too good the condition is somewhat more pronounced in the closing days of 1913. Yet the tangible indications of increased manufacturing facilities are by no means unimportant.

Philadelphia

PHILADELPHIA, PA., December 29, 1913.

Holiday dullness characterizes business. New demand is light in practically every branch of the trade. Little encouragement in an early resumption of buying is seen, as industrial plants generally are bare of large orders, have been operating on a restricted basis, and are now experiencing a longer period of holiday idleness than for many years. Inquiries for odd tools have been sent out by some of the railroads, but purchases are unimportant.

The Belmont Iron Works has a contract for a one-story steel factory building, 100 x 105 ft., to be erected for a sherardizing plant at Twenty-fifth and Wharton streets, in which A. T. Green, Chester, Pa., is interested.

Contractors are estimating on plans for a two and three-story manufacturing building about 400 ft. long to be erected for John T. Baily Company, cordage manufacturer, on Delaware avenue, between Morris and Tasker streets. Puechert & Wunder are the engineers.

The Charles P. Biggan Company, which operates structural and ornamental iron and steel and wire works at 1829 Harlan street, has been incorporated with a capital stock of $150,000. Charles P. Biggan is president, H. P. Forrest vice-president, and Charles R. Mullan secretary. The company plans to increase its facilities materially.

Fire is reported to have entirely destroyed the agricultural implement factory of the Doylestown Agricultural Company, Doylestown, Pa., on December 24, with a loss of $60,000.

Chicago

CHICAGO, ILL., December 29, 1913.

The year closes in the machinery trade with business quiet yet more nearly representing normal conditions than has been true of any period since the advent of the automobile business, with its unparalleled demand for machine tools. The builders of machinery have in the past few months been forced to look to the general industrial field for the bulk of their orders, and under such conditions the Chicago market, which has handled but little of the automobile business, finds itself on a much more satisfactory basis, both as regards prices and deliveries. In the new year much is hoped for from the railroads, whose purchases during 1912, with few exceptions, were somewhat less than might normally be expected.

The Crane Company, Chicago, has taken out a permit covering the building of the first two units of its new plant. The buildings will be 80 x 500 ft. and will cost $450,000.

The Barco Brass & Joint Company, Chicago, has purchased the property at 212 West Illinois street, already improved with a four-story building, into which the company will move.

C. B. Scoville, Chicago, has had plans prepared for the erection of a one-story manufacturing building, 23 x 341 ft., at 4415 Ogden avenue. It will be occupied by the Chicago Carton Company.

The Duquoin Utilities Company, Duquoin, Ill., will increase its capital stock from $150,000 to $200,000 and will extend its electric light and power and waterworks plants at Duquoin, Ill. J. Henry Ward is president.

Bids will be received by the city clerk, Arma, Kan., until January 5 for a waterworks system.

Cleveland

CLEVELAND, OHIO, December 29, 1913.

Builders of machine tools and general machinery, as well as other plants engaged in metal working lines, did a fairly satisfactory business during 1913 in spite of the dullness that has latterly prevailed. In heavy handling equipment orders have not been numerous, but makers have continued to book a good volume of orders for small equipment. Plants which have suffered the most from the slackening of business in the past few weeks are those that depend almost entirely on the automobile trade for their orders, but these were very busy for the greater part of the year. In the foundry trade the volume of business has averaged well. Local jobbing foundries were crowded with work the greater part of the year and did not feel the effects of the falling off in business as soon as manufacturers in many other lines.

While little activity is looked for in machine tool lines during the holiday week, some business continues to come out. One order for 17 tools, aggregating about $9000, was placed, being the largest order taken in this market for some time. An interesting fact in connection with this order is that it came from an automobile manufacturer. One dealer reports a larger volume of sales in December than in any month since August. However, this is exceptional. Machine tool business as a whole in December was about the same in volume as in the previous month. The general feeling appears to be slightly better, and while not much change is expected in January many feel that conditions will begin to improve in the following month.

The Director of Public Service, Ravenna, Ohio, this week receives bids for equipment for enlarging the municipal waterworks plant. The machinery to be purchased includes three motor-driven centrifugal pumps of 2000 gal. per min. capacity, one motor-driven centrifugal sump pump, one 150 or 300-kw. turbo-generator with exciter and condenser, and switchboard.

The Portage Rubber Company, Barberton, Ohio, will enlarge its plant with the erection of a $25,000 addition.

The Mahoning County Light Company, Youngstown, Ohio, is planning the erection of a large power plant.

Cincinnati

CINCINNATI, OHIO, December 29, 1913.

It is generally estimated that metal working plants in this territory will show a total average of about 10 per cent. above 1912. With the machine tool builders the first eight months of 1913 were the most active, and business has now fallen off considerably. In fact, December is estimated to be nearly 50 per cent. behind the corresponding month of 1912. This is attributed to the slack buying on the part of the railroads and automobile manufacturers, as well as the dull export trade. With scarcely any exceptions, all manufacturers in this section are in favor of granting the railroads the 5 per cent. advance in rates asked for, and in this class are

also included the larger jobbers and lumber firms. With this question settled it is believed that business in all lines will soon become normal. The boiler and tank manufacturers are able to operate on fairly good time, and a number of deals are pending that may be closed at an early date.

Power plant equipment and a number of small electric motors will be required by J. F. Dietz & Co., Winton place, Cincinnati, whose plans as to occupying the Schacht Motor Car Company's plant, were recently mentioned.

Heating and ventilating equipment will be required by the Standard Publishing Company, Cincinnati, to be installed in a large building at Eighth and Cutter streets. Walter G. Franz is the engineer in charge of the plans.

It is reported that the Lunkenheimer Company, Cincinnati, has definitely decided to commence work on its proposed foundry addition within the next 30 days. The new building will be 100 x 220 ft., two stories and basement, and will be fitted with the latest type of foundry equipment.

The Michaels Foundry Company, Covington, Ky., is buying equipment for its new brass foundry that will be located in a building on Scott street, formerly occupied by the Standard Oil Company.

The French Brothers-Bauer Company, Cincinnati, has decided to erect a large ice and refrigerating plant on a site secured in West End. Refrigerating and power plant equipment will be required.

The Board of Public Affairs, Caldwell, Ohio, will open bids January 8 for a single or double-acting triplex pump, to be driven by a four-cylinder gas engine. T. P. Glidden is clerk of the village council.

The Springfield Spring Company, Springfield, Ohio, will rebuild its plant recently destroyed by fire. Considerable special machinery will be required.

The Board of Education, Springfield, Ohio, will soon advertise for bids on the necessary equipment to fit up a foundry and forge shop that will be operated in connection with one of the high schools.

Milwaukee

MILWAUKEE, WIS., December 29, 1913.

As would naturally be expected, the past and present weeks are the slowest of the year. Manufacturers are taking advantage of the opportunity offered by broken weeks, holiday lay-offs and cessation of bookings to take inventory and make repairs. Tariff and currency legislation, two principal factors in the life of trade, having now been definitely settled, it is expected that business will resume its steady trend. The railroad situation is none too encouraging, but other lines are being sustained fairly well. Machine tool builders have had probably the most prosperous year in the machinery trade and look for a continuance. Industrial expansion and municipal development promise well for power machinery builders. On the whole, the pessimistic attitude of trade and industry is rapidly changing to cheerfulness.

The Plankinton Packing Company, Milwaukee, has started wrecking in preparation for the construction of a new packing plant to cost $300,000 and to contain a large ice and refrigerating plant. Contracts for the various divisions of the work will be awarded as the work progresses. H. C. Carr is vice-president and general manager.

The Shephard Plating Company has been organized at Racine, Wis., with a capital stock of $5000, by William H. Shephard and Peter Ruetz. A small shop will be equipped at once.

The Diamond Match Company is preparing to build an addition to its match factory at Oshkosh, Wis., at a cost of $100,000. The new building will be of brick, steel and concrete, 63 x 110 ft., three stories, and equipped with woodworking and special machinery.

The Manitowoc Church Furniture Company, Manitowoc, Wis., is having plans made for a new $40,000 factory building, to be operated by electrical power throughout. Charles F. Schuetze is manager.

Heim Brothers, Cuba City, Wis., will build a machine shop and garage, 50 x 100 ft., to cost $10,000 with equipment.

Plans for the new factory group for the Davis Mfg. Company, of Milwaukee, in West Allis, call for a main shop, 250 x 290 ft., of brick and steel, a power house, and an office building. Building operations will begin March 1, the foundations to be laid at once. The investment will exceed $150,000. Contracts for construction and equipment will be awarded about the middle of January.

Detroit

DETROIT, MICH., December 29, 1913.

The year just closing, while productive of a fairly large aggregate of business, cannot be said to have been wholly satisfactory to the tool and machinery dealers of Michigan. In machine tool lines business was good the first few months of the year, but a slackening of activity was noted early in the summer, and in the last half of the year orders were inclined to be scattered and of small individual importance, resulting in the business of the year being hardly up to normal. The most important factor in the local market is, of course, the automobile industry, including the automobile part and accessory trade. While business in these lines has not been curtailed, few large extensions to plants have been made, and most manufacturers have been rather conservative in tool buying. Several local companies have been involved in financial difficulties and there has been a general weeding out of mushroom companies. A considerable number of new accessory manufacturing companies have entered this field, absorbing a fair quantity of equipment. A noticeable feature of the last several months in all industrial lines has been the small number of incorporations, indicating that capital has been loath to invest in new manufacturing enterprises.

The machinery market has been naturally quiet the past week, owing to the holiday season, and there is little business pending. Manufacturers and merchants seem to be of one mind in believing that the next two or three months will find trade rather dull, but they look for a renewal of activity in the spring.

The following new plants have been erected in Detroit during the past year: Paige-Detroit Motor Car Company; Morgan & Wright, five buildings; Detroit Graphite Company; Linde Air Products Company; Detroit United Railway, car and machine shops. The following have made extensions: Solvay Process Company, Cadillac Motor Car Company, Ford Motor Company, Burroughs Adding Machine Company and Swedish Crucible Steel Company.

The Edison Illuminating Company, Detroit, has taken out a building permit covering the erection of a one-story reinforced-concrete power building at its new east side plant, to cost $40,000.

The Banner Cigar Company, Detroit, has had plans prepared for a new five-story brick factory building.

The Rex Motor Company, Detroit, has been incorporated with $75,000 capital stock to manufacture motors by Charles H. Riopelle, William J. Frazier and Alfred G. Robinson. The company's plant will be located at Ford, a Detroit suburb.

The Central South

LOUISVILLE, KY., December 29, 1913.

The machinery situation has been rather quiet the past week. R. G. Dun & Co.'s Louisville office reports that during the first 11 months of 1913 6736 tons of machinery were received in Louisville and 10,888 tons shipped out; while for all of 1912 receipts were 6615 tons and shipments 11,752 tons.

The Owl Film Company, 415 West Green street, Louisville, will install a machine shop. The equipment will consist of machine tools, a motor, etc. Moving picture machines and equipment will be repaired.

The Hinyar Coal Corporation, Hazard, Ky., is in the market for power machinery for a coal-mining plant it is preparing to open. Two 150-hp. boilers, and a 150-kw. direct-connected generator will be installed. Address J. B. Allen.

St. Louis

ST. LOUIS, MO., December 29, 1913.

The interruption of the week's business in the machine tool market by the holiday had its natural effect in slowing up business. Inquiries which do not commit those submitting them are appearing, evidencing that there is a disposition to make capital investment in some degree.

The Independent Packing Company, St. Louis, has completed plans for a cold storage plant, to cost with equipment about $75,000, to be erected at once.

The filtration plant plans of the St. Louis Water Commissioner, recently noted, include pumps, elevator, a refrigerating plant and other apparatus.

The W. R. Pickering Lumber Company, Kansas City, Mo., announces that its plant at Haslam, Texas, when completed and equipped will have a daily capacity of 250,000 ft. Equipment contracts are being let.

The Missouri School for the Deaf, Fulton, Mo., is in the market for new boilers and engines for its power plant, as well as pumps. Bids will close January 13. Address D. A. Sharp, president.

Maingault & Graham, Wilmot, Ark., have acquired a franchise and will equip an electric light and power and waterworks plant at once.

The Cunningham Commission Company, Little Rock, Ark., will rebuild the grain elevator recently burned with a loss of $35,000 on machinery.

The Arkansas Machine & Boiler Works, Stuttgart, Ark., has been incorporated by W. H. Duckett, Thomas F. Ryan and Harvey Toms to engage in machine and boiler manufacture and repair.

Birmingham

BIRMINGHAM, ALA., December 29, 1913.

Large machinery dealers report a successful year. Until the early fall, when the lumber interests began to become slack, the volume of business month by month was ahead of that of any prior period. Since that time the machinery men have felt the prevailing dullness incident to apprehension of tariff changes, the currency bill, etc. They now report that much more cheerfulness prevails and that they expect the new year to be an excellent one. Underlying conditions in the South are good. With a slight impetus in manufacturing and construction lines, machinery will share with other lines. There is a continued demand for small engines and boilers, especially gasoline engines. Machine tools are not in demand.

The Big Sandy Lumber Company, Hull, Ala., is building a bandmill, two dry kilns, etc. Electrical machinery will be installed.

James A. Carney, Carney, Ala.; W. A. Foster, Summerdale, Ala.; C. A. Boller, Foley, Ala., and others, will build a packing plant at Mobile.

The Smith Concrete Tie Company, Birmingham, Ala., has been incorporated with a capital stock of $50,000, by C. D. Smith, G. A. Hegeman, Kyle Lawson and others. It will erect a plant for the manufacture of concrete cross-ties.

Machinery is wanted by the Dade City Broom Company, Dade City, Fla., which is preparing to begin the immediate equipment of a large factory. M. H. Leveille is president of the company.

Texas

AUSTIN, TEXAS, December 27, 1913.

The machinery trade, as well as all other business and industrial activities, continues quiet, although there are no signs of any marked depression. New projects which will be started in 1914 continue to be announced, and, while many of them are only under contemplation, the outlook for the new year is generally encouraging. The work of repairing the damage done in the flooded districts of southern and central Texas is being rapidly carried on.

H. Kempner of Galveston and associates will build a large cotton compress and warehouse at Galveston. The plant will be of fireproof construction. A large amount of equipment will be needed. J. M. Smith is press superintendent of the Kempner interests at Galveston.

The cottonseed oil mill of the Whitewright Cotton Oil Company at Whitewright, which recently was destroyed by fire, will be rebuilt.

The Texas Refining Company, Greenville, will erect a large branch factory at El Paso costing $100,000. C. F. Waugh is El Paso representative of the company.

The Texas & Brazos Valley Railway is installing a large amount of woodworking machinery in its shops at Teague and will soon begin the manufacture of its own cars.

The Pacific Coast

SEATTLE, WASH., December 26, 1913.

A slight increase in business is reported by the prominent machinery dealers of Seattle, and the larger houses in Tacoma, Spokane and Portland are fairly well satisfied with the business which precedes the holidays. Quite a large volume of new business was transacted during the past week, mostly in milling machinery. The mills are preparing for a busy year and are installing new machinery and enlarging their plants. New business from British Columbia, in the vicinity of Vancouver, also made its appearance during the week, several local houses receiving orders for a large amount of milling machinery. When the price of lumber advances several large lumber mills are to be built in the vicinity of Vancouver, and local dealers will receive the orders for machinery. A considerable amount of coal mining machinery was sold in the past 10 days.

The Seattle Brewing & Malting Company, 6015 Duwamish avenue, Seattle, is making some additions to its plant. Some new machinery will be installed in January.

The National Automatic Fender Company, Seattle, has secured a two-acre site on the tidelands, and the first unit of a large factory will be started in the near future. A. M. Ferguson is president of the company.

The port of Seattle, Wash., has decided to build a 500,000-bu. grain elevator on the east waterway of Seattle harbor.

The Seattle Empire Laundry Company, Seattle, Wash., will erect a $30,000 laundry at 2301 Western avenue.

A corporation, presumed to be the Chicago, Milwaukee & St. Paul Railway Company, represented by D. F. Wright, president of the Mason County Abstract & Title Company, Shelton, Wash., recently purchased a water power site on the Skykomish river, near Shelton, and will build a large power plant. W. G. Rex has been awarded the contract to clear the grounds and dam site.

The Southern Pacific Company has built a roundhouse and will install repair shops at Susanville, Cal.

Canada

TORONTO, ONT., December 29, 1913.

Fire destroyed one-third of the tanning plant of the Breithaupt Leather Company, Berlin, Ont., with a loss of over $65,000. The engine room, boiler room and leachhouse were totally destroyed. The plant will be rebuilt.

Fire destroyed the factory of the Thompson Boat Works, at Parry Sound, Ont. The plant will be rebuilt.

The Western Canada Power Company, Vancouver, B. C., is planning to double the capacity of its plant and will put in a 13,000-hp. turbine next year and another in 1915.

The sawmill of the Canadian Collieries, at Cumberland, Vancouver Island, B. C., was totally destroyed by fire. The loss amounted to about $100,000.

A Prince Rupert, B. C., syndicate headed by N. J. McLeod, has secured a granite quarry on Smith Island, B. C., near the Skeena River, and will erect a plant to produce crushed granite and sand, as well as dimension rock.